DOCUMENT RESUME

ED 179 401 SE 029 343

AUTHOR Harmon, Lindsey R.; And Others
TITLE Career Patterns of Doctoral Scientists and Engineers, 1973-77.
INSTITUTION National Academy of Sciences - National Research Council, Washington, D.C. Commission on Human Resources.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE 79
NOTE 85p.; Contains occasional small, light, and broken type

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Employment Opportunities; *Employment Patterns; Engineers; *Professional Occupations; Responsibility; Salaries; Science Careers; *Scientific Personnel; *Scientists; *Surveys

ABSTRACT

This report represents the results of a survey designed to determine the patterns of employment and primary work activity of scientists and engineers in the United States. The report presents the data related to employer categories, areas of primary work activity, and salary increments. Six appendices of data are related to work activity patterns, questionnaires, the percentage time distribution relationship with the primary work activity, and the weighting system used in the report. (Author/SA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
National Academy of Sciences
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SCOPE OF INTEREST NOTICE
The ERIC Facility has assigned this document for processing to: SE HE
In our judgment, this document is also of interest to the clearinghouses noted to the right. Indexing should reflect their special points of view.

ED179401

SE 029 343

CAREER PATTERNS OF DOCTORAL SCIENTISTS AND ENGINEERS

1973-1977

The National Research Council

CAREER PATTERNS OF DOCTORAL SCIENTISTS AND ENGINEERS 1973-1977

Lindsey R. Harmon
Principal Investigator

Betty D. Maxfield
Project Director

An Analytical Study
Prepared for the
National Science Foundation

Survey of Doctorate Recipients
Commission on Human Resources
NATIONAL RESEARCH COUNCIL

NATIONAL ACADEMY OF SCIENCES Washington, D.C. 1979

ACKNOWLEDGMENTS

The Career Patterns report was prepared for the National Science Foundation under the auspices of the Commission on Human Resources of the National Research Council (CHR-NRC). The report is based on data from the 1973 and 1977 Surveys of Doctorate Recipients as well as data from the Doctorate Records File. Employment data of Ph.D. scientists and engineers who were employed in both 1973 and 1977 are examined in the report in relationship to type of employment, primary work activity, and salary.

We acknowledge with thanks many forms of assistance. Support for the project was provided by the National Science Foundation. J. James Brown of the National Science Foundation, Division of Science Resources Studies, provided advice to the survey staff. Lindsey R. Harmon (Director of Research, retired) was the principal investigator for the report. Dr. Harmon developed the outline for the study and also was responsible for the preparation of the final manuscript of the report. Susan Henn, research assistant, programmed the numerous data tabulations for the report and served as the production manager for the final manuscript. Dorothea Jameson, professor, University of Pennsylvania, served as the principal Commission reviewer. Other reviewers included Nancy Ahern, Porter Coggeshall, Dorothy Gilford, and Andrew Spisak, all CHR staff members.

It is hoped that the data presented in this report will be useful to the universities and departments that provide doctoral education, to agencies concerned with human resources in science and engineering, and to the science and engineering Ph.D.'s themselves.

Betty D. Maxfield
Director
Survey of Doctorate Recipients

CONTENTS

Highlights vii

Introduction 1

Chapter 1 - Employer Categories 5

Chapter 2 - Patterns of Primary Work Activity 13

Chapter 3 - Plans at Ph.D.: Foreshadows of Coming Events .. 27

Chapter 4 - Salary Patterns of Ph.D. Scientists and Engineers 35

APPENDICES

Appendix A: Percentage Time Distribution and Primary Work Activity 53

Appendix B: Primary Work Activity Patterns of Doctoral Scientists and Engineers, 1973-1977 61

Appendix C: Questionnaire and Specialties List 1973 Survey of Doctoral Scientists and Engineers 65

Appendix D: Questionnaire and Specialties List 1977 Survey of Doctorate Recipients 69

Appendix E: Questionnaire and Specialties List Survey of Earned Doctorates 75

Appendix F: Weighting Procedure 79

HIGHLIGHTS

- The active respondents to the 1973 and 1977 sample Surveys of Doctorate Recipients represent about 20 percent of the Ph.D.'s who graduated in the early 1930's, about half of those in the early 1940's, and 80 percent of those who have graduated since 1950. The remainder have died, have retired, or have never responded to survey questionnaires. This report is based on a portion of the active respondent group--those who were employed in both 1973 and 1977.
- Over half of the active career group are employed in academe; those in business and industry are almost 30 percent of the small active 1934-1945 Ph.D. cohort, but a lower percentage of the more recent cohorts, down to 16 percent of the 1970-1972 Ph.D.'s.
- There was a considerable influx into business and industry from academe between 1973 and 1977.
- Teaching is the primary work activity (PWA) of about half of those--both men and women--employed in academe. Research is next (13.5 percent of men and 15 percent of women) and administration third (6.2 percent of men and 2.6 percent of women). Switching primary activity between 1973 and 1977 is characteristic of almost 30 percent of both sexes employed in academe.
- The business/industrial world employs proportionately fewer women than does academe. Of the men employed in this sector, 29 percent are in administration, compared to less than 9 percent of the women, while research occupies 25 percent of the women but only 19 percent of the men.
- In the U.S. government, primary work activities are similarly distributed for men and women, but women comprise only 4 percent of the total.
- Switching primary work activity in academe tended to take both men and women out of teaching between 1973 and 1977, while the flux into research about balances those leaving. Administration and "all other activities" received more than they lost. This pattern tends to hold for all field groups and most cohorts.

- Plans at Ph.D. give strong indications of sector of employment for up to 20 years after graduation. This was found for all fields and all major employment categories.
- Median salaries for full-time employed Ph.D. scientists and engineers increased 22.5 percent between 1973 and 1977, while the Consumer Price Index increased 43.1 percent. Increments vary by cohorts: older cohorts, with higher salaries, gained proportionately less than did the younger Ph.D.'s.
- Salaries vary by field, sex, employer category, and primary work activity, and the general pattern of variation was much the same in 1973 and 1977. In general, remuneration is highest in the engineering, math, and physical science fields, and lowest in the life sciences. Mean salaries of women are lower than those for men in all fields.
- Men in academe earn less than those in government or in business and industry. In academe, teaching pays least, administration most, for the 1957--1966 cohort. For the younger men, staying in research pays least but shows greater 1973-1977 increments than staying in teaching. Administration pays most, and switching into administration has the highest financial rewards.
- In business and industry, where there is relatively little teaching, salaries for administration are higher than for research, as is true also in academe.
- Relative variation in salaries (standard deviation divided by the mean) is highest in business and industry, lowest in government. It declined in government from 1973 to 1977, while it increased in business and industry.

INTRODUCTION

This study was designed as a brief examination and description of the patterns of employment and primary work activity of the nation's doctoral scientists and engineers, based on the 1973 and 1977 Surveys of Doctorate Recipients, conducted by the Commission on Human Resources, NRC. This short report will be concerned with the numbers of persons in various field groups, employer categories, and areas of primary work activity, along with some data relating to salaries and salary increments. The Profile reports of 1973, 1975, and 1977 provide data on these items as discrete entities. The present report seeks out some of the relationships among them. It does not, however, attempt to draw any policy implications.

Data Sources

Data for this study of career patterns come from two separate sources: the Doctorate Records File and the Survey of Doctorate Recipients. The Doctorate Records File (DRF) contains data on every Ph.D. granted by a U.S. university since 1920. For the years 1920-1956, the data are limited to the year, institution, and field of all degrees (BA, MA, and Ph.D.--or equivalents). From 1957 on, many more data are available from a questionnaire completed by each new Ph.D. For the present report, the significant information used from this source concerned plans at Ph.D. graduation, particularly the anticipated employer category. The second source is the biennial survey of a sample of Ph.D.'s drawn from the DRF. The sample is so drawn as to include approximately one-sixth of the total group, stratified by sex, field, and year of graduation. Within this three-dimensional stratification table, random samples are drawn from each cell, with more intensive sampling of the smaller cells, to help insure that all groups are reliably represented. Weights based on sampling rates and response rates are then applied to the respondents, so that the final result represents as accurately as possible the whole population within each cell, and by summation, the entire science and engineering population of U.S. Ph.D. origin. The Comprehensive Roster also contains those Ph.D.'s of foreign

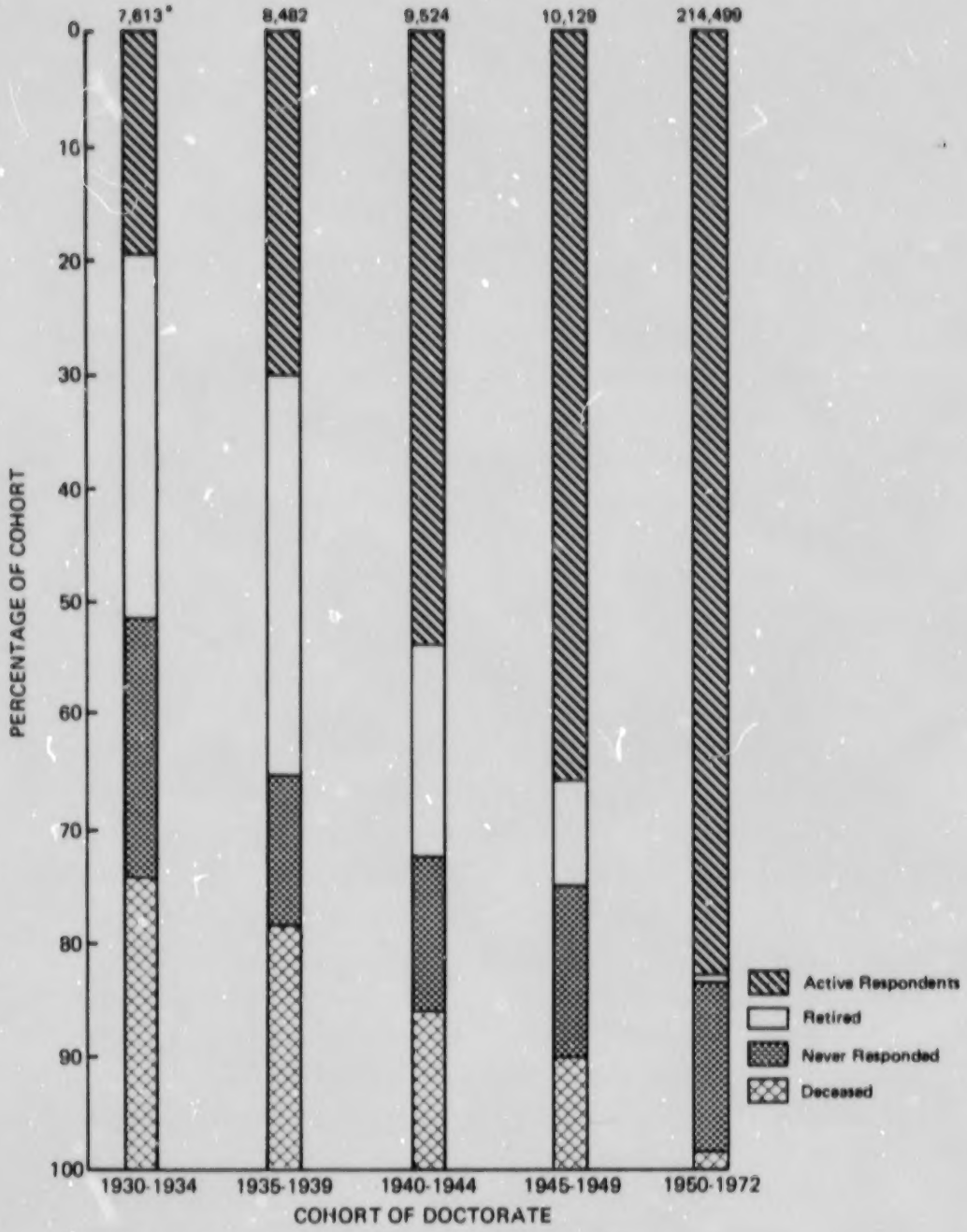


FIGURE 1 Doctoral Science and Engineering Sample by Ph.D. Cohort and Response Category, 1973-1977

origin who could be located, and U.S. non-science Ph.D.'s working in science, but these other groups were not included in the population of this report. For the present report, only data from the 1973 and 1977 surveys were used. These people were also surveyed in 1975, but the data from these questionnaires were not included, simply because the resources available for the study were not sufficient to analyze the shorter-term career changes. In the 1973 and 1977 questionnaires the questions asked referred mostly to current employment. The data used in this study concerned employer category, primary work activity (PWA) and salary. The questionnaire forms used in 1973 and 1977, and the Survey of Earned Doctorates questionnaire are shown in Appendices C, D, and E. An explanation of the weighting procedure used in this report is given in Appendix F.

Active Career Group

The first step in data preparation consisted of an examination of the entire sample, to find out how many had active careers in 1977. The object of this first step was to account for and then eliminate from the analysis those who had never responded, those who had died, and those who had retired. The results of this first step are portrayed graphically in Figure 1, and the numerical data are given in Table 1. The sample is divided into 5-year graduation cohorts for the Ph.D.'s granted between 1930 and 1950, but with a single cohort for those who graduated in 1950 or later. The reason for this latter step is apparent in the graph: there is, as expected, a strong relationship between the proportion of active respondents and recency of graduation. Of the 1930-1934 Ph.D.'s, approximately one fourth had died, an additional fourth never responded to the survey questionnaires, and about 30 percent had retired, leaving as active respondents in 1977 only about 20 percent. The proportion of active respondents was somewhat higher among the 1935-1939 Ph.D.'s (30 percent), while over half of the 1940-1944 Ph.D.'s were in this category. For the 1945-1949 Ph.D.'s, the active proportion climbs to about two out of three, and for those graduating since 1950 to more than four out of five. In this final group, almost all of those omitted from the analysis were nonrespondents; very few had died or retired. The never-responding group is a relatively constant proportion of all cohorts--slightly larger among the oldest group. This

report will henceforth be concerned with the active respondent group.

TABLE 1 Doctoral Scientists and Engineers by Ph.D. Cohort, Sex, and Response Category, 1973-1977

Ph.D. Cohort	Sex	Total (N)	Deceased (%)	Never Resp. (%)	Retired (%)	Active Resp. (%)
1930-34	Men	6,737*	26.3	21.7	32.0	19.9
	Women	876	21.2	29.7	35.7	13.4
	Both	7,613	25.8	22.6	32.5	19.2
1935-39	Men	7,511	21.2	13.0	34.2	31.7
	Women	951	24.1	13.4	42.5	19.0
	Both	8,482	21.5	13.0	35.2	30.3
1940-44	Men	8,745	14.2	13.5	17.7	54.5
	Women	779	13.5	11.8	29.1	45.6
	Both	9,524	14.1	13.4	18.7	53.8
1945-49	Men	9,176	9.7	15.2	8.3	66.8
	Women	953	11.9	17.4	13.9	56.9
	Both	10,129	9.9	15.4	8.8	65.9
1950-72	Men	195,877	1.8	14.8	0.7	82.7
	Women	18,622	2.3	15.6	1.6	80.5
	Both	214,499	1.9	14.8	0.8	82.5

*Numbers shown in the table are weighted n's. See Appendix F for an explanation of the weighting system used.

CHAPTER 1

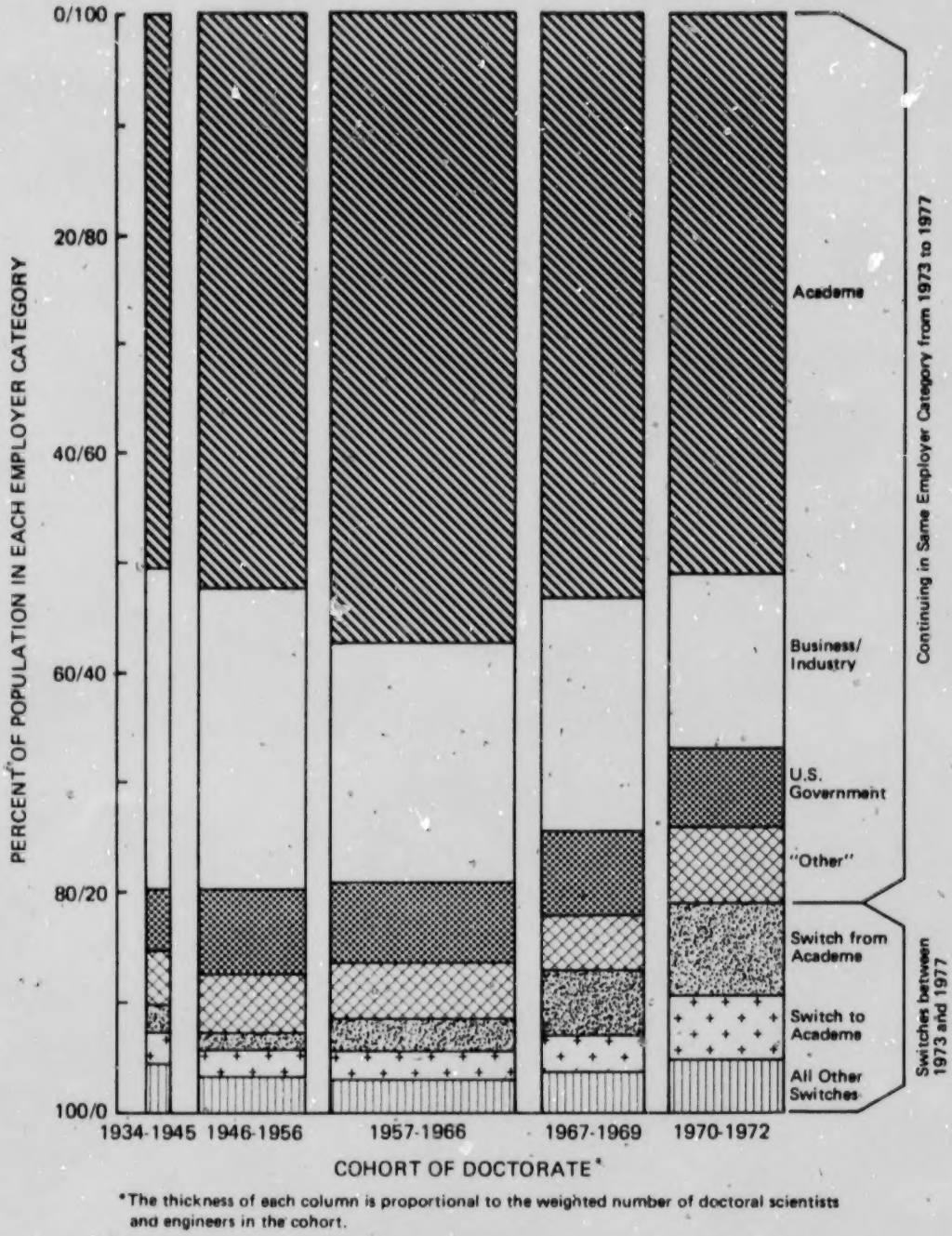
EMPLOYER CATEGORIES

The Varying Size of Cohorts

The active respondents are grouped in a different set of cohorts in Figure 2 and Table 2, which present data about employer categories. The new cohort groupings are designed to bring into focus the variations in experience of the more recent Ph.D.'s. The pre-1934 Ph.D.'s are excluded because they were not surveyed in 1977. The older group include the Ph.D.'s of 1934-45, as their career experience during the survey period is relatively homogeneous and the numbers during this period were small. In Figure 2, the thickness of each column is proportional to the weighted number of Ph.D.'s in the cohort. Thus the earliest column is very thin. The second cohort, 1946-1956, comprises the group maximally affected by the immediate post-World War II boom in academe--the so-called "GI Period". The third cohort, 1957-1966, covers the period of enormous growth in doctorate output in American universities. The fourth cohort, 1967-1969, represents a period of transition, the onset of what has been termed the "new academic depression". The final cohort, 1970-1972, represents the most recent Ph.D.'s for whom data on career patterns for the period 1973-1977 are available.

Major Employer Categories

The columns representing the cohorts in Figure 2 are divided vertically to illustrate the employer categories of the respondents in these several groups. The largest group, illustrated at the top of each column, consists of those who were employed in the academic world both in 1973 and 1977. This group includes those employed in colleges and universities in these two years, and is referred to herein as the "continued academe" group. Its proportion



*The thickness of each column is proportional to the weighted number of doctoral scientists and engineers in the cohort.

FIGURE 2 Employer Category by Ph.D. Cohort for Doctoral Scientists and Engineers, 1973-1977

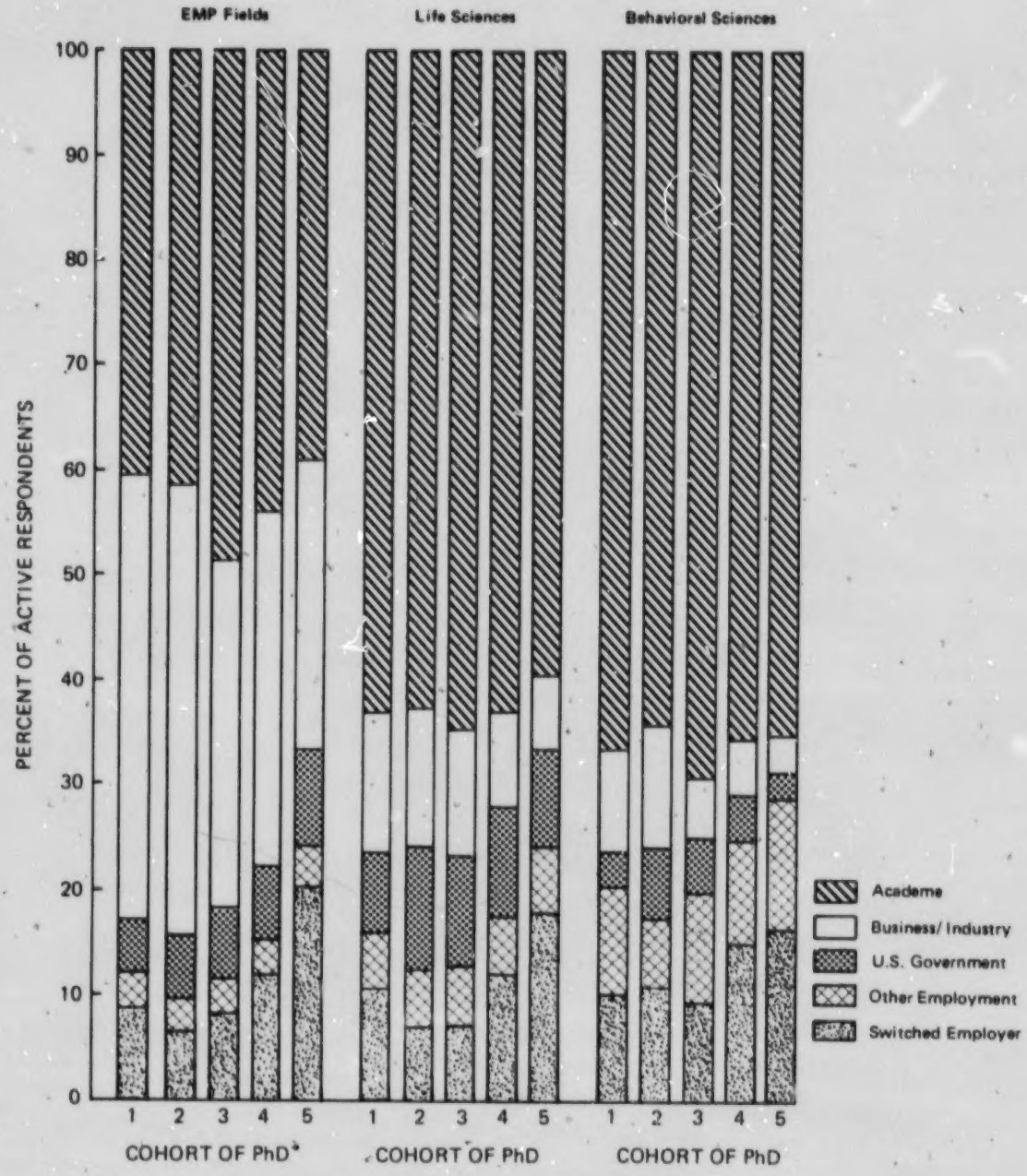
of the total Ph.D. science and engineering population increases from cohort 1 through cohort 3, then decreases again, corresponding to the diminished opportunities for new Ph.D.'s in the academic world from the late 1960's onward. The second segment, those who continued to be employed in business and industry (including self-employed), decreases proportionately through the several cohorts, illustrating the fact that business and industry did not immediately take up the slack from the diminished opportunities in academe. The third segment, the "continued U.S. government" group, employed by the Federal government in 1973 and 1977, is decidedly smaller than either of the preceding groups, and does not vary a great deal. The relatively small number of unemployed (1.2 percent of the science and engineering population in 1973 and 1977) are excluded from these tabulations.

Other Employers, and Employment Shifts

The remaining segments are concerned with those who have switched employer categories between 1973 and 1977, and those who were, in both years, employed in some other or unknown category. This group, immediately below the "continued U.S. government" group, includes the nonprofit organizations. The next segment, representing those who switch from the academic world to something else, increases progressively from the second through the fifth cohort. It includes those who completed postdoctoral appointments and then left for employment in business, industry, government, or elsewhere. The next-to-last segment, representing those who switched to the academic world from elsewhere, increases in proportion through the several cohorts, but it is a rather small segment. The increasing size is most simply interpreted as representing the relatively greater mobility of the younger scientists and engineers--an interpretation that applies, of course, also to those who switch out of academe. The final group, at the bottom of the columns, includes all other kinds of switches, as well as those who were never in academe, business, or government. It includes also those whose employer category is unknown.

Employer Categories by Field Group

Figure 3 is somewhat similar to Figure 2, but breaks out three field groups; it does not show relative size by column thickness, as did Figure 2. There are



*Cohort 1 refers to years 1934 to 1945; cohort 2, 1946 to 1956; cohort 3, 1957 to 1966; cohort 4, 1967 to 1969; cohort 5, 1970 to 1972.

FIGURE 3 Employer Category by Ph.D. Field and Cohort for Doctoral Scientists and Engineers, 1973-1977

three broad field groups. The first, called the EMP fields, is comprised of Engineering, Mathematics, and the Physical Sciences, the latter including physics, chemistry, and the earth and atmospheric sciences. The second group, the Life Sciences, includes all the biological, medical, and agricultural sciences. Biochemistry, biophysics, and biostatistics are included in this group. The Behavioral Sciences comprise the third field group. This includes psychology and the social sciences: anthropology, sociology, economics, political science and international relations, geography, communications, and area studies. The complete list within each of these areas is shown in the Specialties List in Appendix E. For more detailed information on the numbers in this presentation, see Table 2. Within each field group and cohort, Figure 3 shows the proportions who continued to be employed in academe, in business and industry, in U.S. government, and in all other categories in 1973 and 1977. At the bottom, it shows the proportion who switched categories, with the types of employer-category switches combined. This proportion, it is readily noted, is larger in the most recent cohorts. In the EMP fields it is smallest in cohort 2, in the life sciences and the behavioral sciences the switching is at a minimum in cohorts 2 and 3. With respect to employer categories, the high proportion in business and industry in the EMP fields is the outstanding feature of Figure 3. Less striking, but probably important, is the decreasing proportion of the behavioral scientists in business and industry, including the self-employed, in cohorts 2 through 5. The "Other Employment" category is at a minimum in the EMP fields, and largest in the behavioral sciences. The U.S. government employs proportionately more life scientists in each cohort, and a smaller proportion of behavioral scientists than do the other sectors.

Sex Differences in Employer Categories

There are certain consistent sex differences in proportions of Ph.D.'s in various employer categories, as shown by the percentage figures in Table 2. For example, if one examines the percentage distribution across employer categories, one notes that women are concentrated in academe, and that the differences are larger for the more recent cohorts. The generalization holds most strongly for the EMP fields, less so for the life sciences, but is not true for the behavioral sciences. In the business/industrial world, it is men

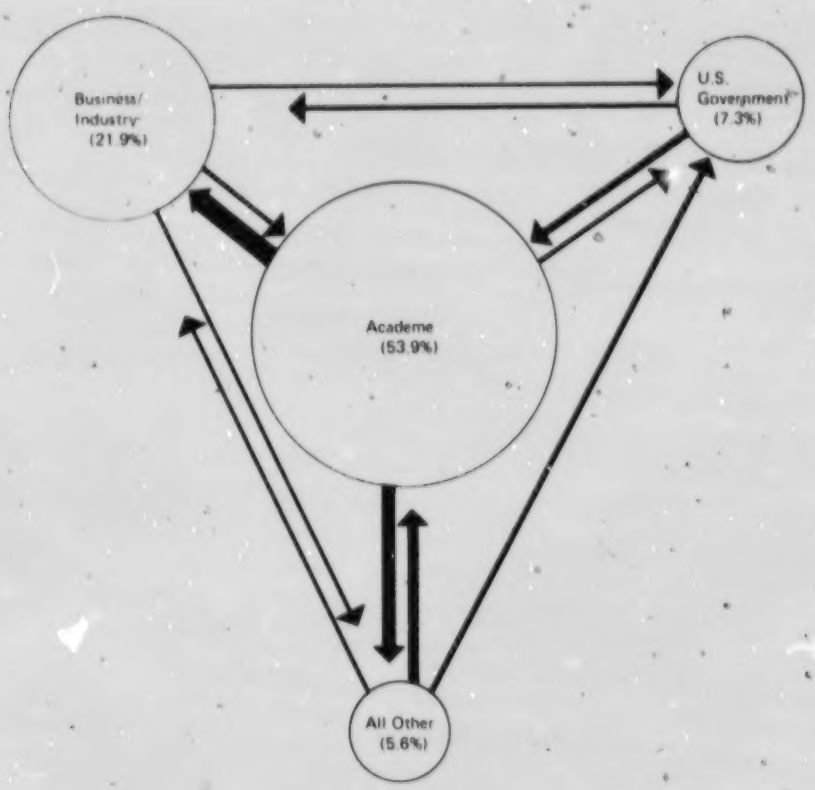
TABLE 2 Employer Category Patterns of Doctoral Scientists and Engineers by Cohort, Field of Doctorate, and Sex, 1973-1977

Employer Category Patterns by Field Group, 1973-1977	1934 to 1945			1946 to 1956			1957 to 1966			1967 to 1969			1970 to 1972			Total 1934 to 1972		
	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both
TOTAL, ALL FIELDS	4,964	307	5,271	22,122	1,116	23,238	38,471	2,492	40,963	20,729	1,687	22,416	22,357	2,532	24,889	108,643	8,134	116,777
Continued in																		
Academe	50.3	57.0	50.7	51.8	61.3	52.2	56.6	66.9	57.2	52.4	65.6	53.4	49.9	61.7	51.1	53.1	63.9	53.9
Business/Industry	30.3	11.4	29.2	28.5	10.7	27.7	22.7	6.6	21.7	22.5	4.9	21.2	17.2	3.9	15.9	23.1	6.2	21.9
U.S. Government	4.9	4.9	4.9	7.5	7.2	7.5	7.4	5.4	7.3	7.7	3.0	7.4	8.0	2.7	7.4	7.5	4.3	7.3
Other Employment	5.0	16.3	5.7	4.9	9.4	5.1	5.1	10.6	5.5	4.8	10.8	5.3	6.2	10.8	6.6	5.2	10.7	5.6
Switched 1973 to 1977																		
From Academe	2.6	2.9	2.6	1.5	3.5	1.6	2.8	3.7	2.8	5.9	6.9	5.9	8.5	9.7	8.6	4.3	6.2	4.4
To Academe	3.0	4.2	3.1	2.9	2.5	2.9	2.9	3.4	2.9	3.6	3.9	3.6	5.6	6.0	5.7	3.6	4.2	3.6
Other Switchers	3.8	3.3	3.8	2.8	5.5	2.9	2.6	3.5	2.6	3.1	4.9	3.2	4.6	5.2	4.7	3.2	4.6	3.3
EMP Fields	2,859	74	2,933	11,406	287	11,693	20,725	471	21,196	11,575	330	11,905	11,379	413	11,792	57,944	1,575	59,519
Continued in																		
Academe	39.8	55.4	40.2	41.0	59.2	41.4	48.2	65.4	48.6	43.1	67.0	43.8	37.7	63.0	38.6	43.3	63.5	43.8
Business/Industry	43.2	16.2	42.6	43.2	18.8	42.6	33.6	13.8	33.2	34.1	12.1	33.5	28.4	8.5	27.7	35.1	13.1	34.5
U.S. Government	4.3	8.1	4.4	5.8	9.4	5.9	6.6	7.0	6.6	7.4	5.2	7.3	9.3	6.3	9.2	7.0	6.9	7.0
Other Employment	3.7	9.5	3.9	3.3	4.5	3.4	3.3	6.2	3.4	3.6	3.3	3.6	3.9	3.6	3.9	3.5	4.8	3.5
Switched 1973 to 1977																		
From Academe	2.9	2.7	2.9	0.9	3.1	1.0	2.4	3.6	2.4	5.5	5.8	5.5	10.0	10.7	10.0	4.2	5.8	4.3
To Academe	2.7	5.4	2.7	3.5	3.1	3.5	3.4	2.8	3.4	3.8	3.9	3.8	6.4	5.3	6.3	4.0	3.9	4.0
Other Switchers	3.4	2.7	3.3	2.1	1.7	2.1	2.3	1.3	2.3	2.6	2.7	2.6	4.4	2.7	4.3	2.9	2.1	2.8
Life Sciences	1,425	116	1,541	6,231	386	6,617	9,902	936	10,838	5,012	551	5,563	5,562	924	6,486	28,132	2,913	31,045
Continued in																		
Academe	63.5	53.4	62.8	62.0	69.9	62.4	64.0	69.0	64.4	62.0	72.6	63.0	58.8	65.5	59.7	62.1	68.1	62.7
Business/Industry	13.5	11.2	13.4	13.6	5.4	13.1	12.6	5.0	11.9	9.7	2.2	9.0	7.5	2.5	6.8	11.3	4.0	10.6
U.S. Government	7.0	7.8	7.1	11.8	8.3	11.7	10.9	7.2	10.5	11.3	3.1	10.5	10.3	3.6	9.3	10.9	5.5	10.3
Other Employment	5.3	21.6	6.6	6.1	7.5	6.2	5.4	7.3	5.6	4.6	9.6	5.1	6.0	5.0	5.9	5.5	7.6	5.7
Switched 1973 to 1977																		
From Academe	2.5	3.4	2.6	1.8	3.1	1.9	2.9	3.3	3.0	4.9	7.1	5.2	7.7	10.9	8.1	4.0	6.4	4.2
To Academe	3.9	2.6	3.8	2.1	0.8	2.0	2.2	4.2	2.3	3.9	3.6	3.9	5.9	9.5	6.4	3.3	5.3	3.5
Other Switchers	4.2		3.9	2.6	4.7	2.7	2.0	4.1	2.2	3.6	1.8	3.4	3.8	3.0	3.7	2.9	3.2	2.9
Behavioral Sciences	680	117	797	4,485	443	4,928	7,844	1,085	8,929	4,142	806	4,948	5,416	1,195	6,611	22,567	3,646	26,213
Continued in																		
Academe	67.1	61.5	66.2	65.0	55.1	64.1	69.4	65.8	69.0	66.7	60.2	65.6	66.5	58.2	65.0	67.3	60.6	66.3
Business/Industry	11.0	8.5	10.7	12.0	9.9	11.8	6.6	4.9	6.4	5.7	3.8	5.4	3.7	3.4	3.6	7.0	4.9	6.7
U.S. Government	2.9		2.5	5.7	4.5	5.6	5.0	3.1	4.8	4.3	2.0	3.9	2.8	0.8	2.5	4.4	2.2	4.1
Other Employment	9.7	15.4	10.5	7.3	14.2	7.9	9.5	15.3	10.2	8.8	14.8	9.8	11.1	17.7	12.3	9.3	15.9	10.2
Switched 1973 to 1977																		
From Academe	1.6	2.6	1.8	2.5	4.1	2.7	3.6	4.1	3.7	8.1	7.2	7.9	6.3	8.5	6.7	4.8	6.1	5.0
To Academe	2.9	5.1	3.3	2.6	3.6	2.7	2.4	2.9	2.4	2.6	4.1	2.8	3.8	3.6	3.8	2.8	3.6	2.9
Other Switchers	4.7	6.8	5.0	4.8	8.6	5.2	3.4	3.9	3.5	3.8	7.9	4.5	5.9	7.8	6.3	4.4	6.7	4.7

who predominate in percentages. This is true in all fields. The percentages of men in U.S. government service are greater than those for women in all fields and cohorts, except for the EMP fields in the first cohorts. In the miscellaneous "Other Employment" category the percentages of women are higher in all cohorts in all fields where the N's are large enough for reliable data.

Summary Regarding Employer Categories and Interchanges

Figure 4 summarizes very briefly the relative numbers of science and engineering Ph.D.'s employed in the various categories, combining all fields and cohorts from 1934 to 1972. The area of each circle is proportional to



Area of circle is proportional to number employed 1973-1977 in the same category. Width of interchange paths is proportional to number shifting, 1973-1977.

FIGURE 4 Interchanges Between 1973 and 1977 Among Employer Categories of Science/Engineering Ph.D.'s of 1934-1972

the number of persons remaining in the category over the 4-year period 1973 to 1977, and the width of the bars showing interchanges is proportional to the number of scientists and engineers making each of the indicated shifts. As Figure 4 shows, the amount of interchange between the academic world and the "all other" category is out of proportion to the size of this miscellaneous "all other" group. Perhaps this is attributable to the non-profit organizations included in the miscellaneous group. The more frequent shifts out of the U.S. government, as compared to shifts into it, are noteworthy as are the shifts from academe to business and industry, which we have already mentioned and attributed in part to persons completing postdoctoral training.

CHAPTER 2

PATTERNS OF PRIMARY WORK ACTIVITY

In the first chapter we examined the distribution of employer categories for the science and engineering Ph.D.'s by cohort of doctorate. In this chapter we will look at the functions performed by these people, as indicated by their primary work activities (PWA) and changes in PWA over the period 1973 to 1977. Because the work activities are distinctly different in the academic and non-academic worlds, these sectors are kept separate. There are also variations by cohort of Ph.D., by field, and by sex. It seems appropriate, however, to first give more description of what is meant by primary work activity. It clearly does not mean the only or the exclusive work activity for most scientists and engineers. This is particularly true in the academic environment, where teaching and research frequently are so intimately coupled as to make any separation somewhat arbitrary.

Some light can be shed on this question by considering the distribution of time among work activities as well as by PWA. In the 1977 survey, respondents were asked to estimate their time distribution among a number of activities that were then summated into four categories corresponding to the four primary work activities of teaching, research, administration, and "other". A comparison of these two ways of describing one's work can be made by cross-tabulations which show the time distribution, and number of activities engaged in, by persons who designate each of the primary activities. Most respondents stated that their primary work activity occupied well over half of their time, and usually far more than that. Exclusive devotion to a single activity is infrequent in the academic world, however, characterizing from 10 percent to 20 percent of the respondents. It is much more frequent in the nonacademic environment, characterizing from 25 percent to 40 percent of the cases. The following table

briefly summarizes the proportions of respondents, by PWA, who indicate (1) exclusive devotion to one activity, (2) two activities, and (3) three or four activities in their time distributions.

	PRIMARY WORK ACTIVITY			
NUMBER OF ACTIVITIES	Teaching	Research	Administration	Other
Exclusive: Single Activity	10.7	21.0	31.2	37.7
Two Work Activities Listed	38.5	39.0	35.1	35.6
Three or Four Work Activities	50.8	40.0	33.7	26.7

The patterns of time distribution, for those designating each PWA, is far more complicated than the preceding brief table indicates. In fact, it was found that there were a total of 91 different patterns of time distribution, even when the percentages of time were simplified to exclusive, high, medium, and low, with a stated range of time percentages in each of these sets. For those interested in a fuller understanding of the relationship of time distribution and PWA, the question is developed rather extensively in Appendix A. Suffice it for the discussion that follows to keep in mind the fact that when a PWA is stated, it means, for most respondents, primary but not exclusive time devoted to an activity, and that a relative shift in emphasis may move an individual from one PWA to another, without a fundamental change in the nature of the work performed.

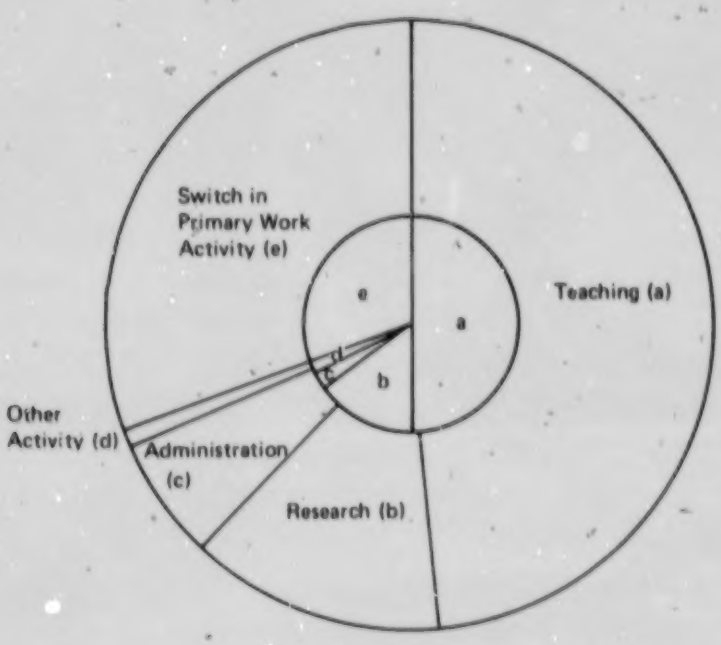
A Pie Chart of PWA

To show the most general picture, the primary work activities of those who remained in academe over the 4-year period are depicted in Figure 5. The area of the center circle is proportional to the number of women, and that of the outer ring proportional to the number of men, so that the total represents the entire academic world of science and engineering Ph.D.'s. Each circle is sectioned to show the proportion of people engaged in teaching (the largest section), research, management or administration (hereafter simply termed administration), and other activities over the entire 4-year period, and those who switched PWA between 1973 and 1977. The data of Figure 5 include all the 1934-1972 Ph.D. graduates. More detail, by cohort and sex, is provided in

Table 3, which shows all fields combined. Tables giving the corresponding data for the three field groups, EMP fields, life sciences, and behavioral sciences, are presented in Appendix Table B..

Sex Differences and Resemblances

It is interesting to note in Figure 5 the rather close resemblance between men and women in distribution of primary work activity--except for administration. The proportion of men is higher by a factor of almost 2.5. Examination of Table 3 shows this difference to be characteristic of all cohorts, although in differing degrees. Examination of Table 3 also shows that, for the oldest cohort, there is a complete exclusion of women from administration in the study sample.



Inner circle represents women, outer portion men; area is proportional to number of cases.

FIGURE 5 Primary Work Activity-Distribution of Doctoral Scientists and Engineers Employed in Academe, 1973-1977

TABLE 3 Primary Work Activity Patterns by Ph.D. Cohort and Sex for Doctoral Scientists and Engineers

Primary Work Activity Pattern, 1973-1977	1934 to 1945			1946 to 1956			1957 to 1966		
	Men	Women	Both	Men	Women	Both	Men	Women	Both
TOTAL, ALL FIELDS	2,499	175	2,674	11,437	680	12,117	21,762	1,665	23,427
Constant, 1973-1977	65.7	74.3	66.2	69.2	71.5	69.3	66.1	67.7	66.2
Teaching	42.9	64.0	44.3	44.7	50.6	45.1	46.6	47.2	46.7
Research	12.4	9.7*	12.2	12.2	12.6	12.2	11.8	15.4	12.1
Administration	9.5		8.9	11.8	6.3	11.5	6.7	3.7	6.5
Other Activity	0.8*	(0.6)	0.8*	0.4*	1.9*	0.5	1.0	1.4	1.0
Switched, 1973-1977	34.3	25.7	33.8	30.8	28.5	30.7	33.9	32.3	33.8
Into Teaching	9.5	4.6*	9.2	8.8	6.8	8.7	10.3	8.6	10.2
Out of Teaching	13.8	18.9	14.1	14.1	12.2	14.0	16.8	15.8	16.7
Into Research	8.6	(2.3)	8.2	8.5	5.0	8.3	8.6	6.6	8.5
Out of Research	7.1	2.3*	6.8	7.4	7.4	7.4	9.3	7.4	9.1
Into Administration	9.2	11.4*	9.3	9.0	9.3	9.1	9.4	9.1	9.4
Out of Administration	7.7	(2.3)	7.4	5.9	4.3*	5.9	5.0	4.8	5.0
Into Other Activity	4.4	4.6*	4.4	3.1	5.3	3.2	3.5	5.9	3.6
Out of Other Activity	2.5	(1.1)	2.4	1.7	1.9*	1.7	1.6	2.9	1.7

[1] Numbers shown in the table are weighted n's. Where weighted n's or percentages are based on fewer than 3 individuals, an asterisk.

This holds, of course, for each field group also, as shown in the appendix tables. In the oldest cohort, teaching is the PWA for 64 percent of the women as compared with 43 percent of the men; in the 1970-1972 cohort the differences are very small, although the administrative difference persists. (In Table 3, and in Tables 4 and 5 to follow, where the unweighted number of cases is less than 3, the data are shown in parentheses; where the unweighted number is less than 10, an asterisk indicates this fact).

The bottom portion of Table 3 concerns switches in primary work activity, which will be dealt with in a later section of this report.

PWA by Field Group

By reference to Appendix Table B.1, one may note that the pattern of PWA shows common characteristics across all fields; the cohort/sex differences are pervasive. In the oldest cohort more of the women are engaged primarily in teaching; in the younger cohorts the work function balance is more even, except for administration. It would be of interest in future studies to relate these patterns to other factors, such as age at Ph.D., family background, and the baccalaureate and doctorate origins of these people.

Employed in Academe, 1973-1977[1]

1967 to 1969			1970 to 1972			Total 1934 to 1972		
Men	Women	Both	Men	Women	Both	Men	Women	Both
10,855	1,106	11,961	11,162	1,561	12,723	57,715	5,187	62,902
69.8	68.2	69.6	70.2	67.2	69.8	68.2	68.4	68.2
50.1	49.4	50.0	50.5	49.5	50.4	47.5	49.4	47.6
15.6	16.0	15.6	16.5	15.4	16.4	13.5	15.0	13.7
3.1	1.7*	3.0	1.6	0.6*	1.5	6.2	2.6	5.9
1.0	1.1*	1.0	1.5	1.6*	1.5	1.0	1.4	1.0
30.2	31.8	30.4	29.8	32.8	30.2	31.8	31.6	31.8
7.8	7.7	7.8	10.6	14.0	11.0	9.6	9.6	9.6
15.7	17.7	15.9	13.6	13.1	13.6	15.3	15.0	15.3
9.4	8.0	9.2	8.3	8.7	8.4	8.7	7.2	8.6
9.3	9.9	9.3	11.7	12.6	11.8	9.3	9.3	9.3
7.4	9.8	7.6	6.4	5.6	6.3	8.4	8.3	8.4
2.8	1.5*	2.7	1.8	3.8	2.1	4.3	3.6	4.2
4.1	4.2	4.1	3.3	3.9	3.4	3.5	4.8	3.6
1.3	1.8*	1.3	1.7	2.0	1.7	1.6	2.2	1.7

they are enclosed in parentheses; where based on 3 to 9 individuals, they are marked with

PWA of Men and Women Ph.D.'s in Nonacademic Environments

Figure 6 shows, in the same manner as Figure 5, the distribution of primary work activities in the sectors of business/industry and the U.S. government. It is noteworthy, in both cases, that the proportion of women is much lower than in academe. The distribution of PWA is of course different, as there is practically no teaching (the few cases have been lumped under "other activities"). As seen in both Figure 6 and Table 4, women who were employed in business/industry in both 1973 and 1977 proportionately do somewhat more research, but very little administration, and a larger proportion of the miscellaneous "other activities" than did men. Proportionately fewer women who remain in the business/industry environment shifted primary work activities than did men. In the U.S. government, as also seen in Table 5, the proportions of the various work activities are more nearly even between the two sexes, although the greater number of men in administrative positions is still evident. Corresponding data by field group, for business/industry and U.S. government, are given in Appendix Tables B.2 and B.3. In all tables, where the number of sample individuals is small, the fact is noted by placing the percentages in parentheses where they are based on fewer than 3 cases, and marking with an asterisk percentages based on fewer than 10 cases.

TABLE 4 Primary Work Activity Patterns by Ph.D. Cohort and Sex for Doctoral Scientists and Engineers Employed in Business/Industry, 1973-1977[1]

Primary Work Activity Pattern, 1973-1977	1934 to 1945			1946 to 1956			1957 to 1966			1967 to 1969			1970 to 1972			Total 1934 to 1972		
	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both
TOTAL, ALL FIELDS	1,500	35	1,535	6,307	115	6,422	8,741	165	8,906	4,674	83	4,757	3,839	99	3,938	25,061	497	25,558
Constant, 1973-1977	69.3	80.0	69.5	73.4	80.0	73.5	64.8	65.5	64.8	58.4	74.7	58.7	50.7	80.8	51.4	63.9	76.4	64.1
Teaching		(11.4)	(0.3)														(0.8)	
Research	12.0	(5.7)	11.9	14.8	20.0	14.9	20.0	26.7	20.1	23.4	10.1	23.6	22.2	11.3	22.4	19.2	21.2	19.3
Administration	38.5	(5.7)	37.8	43.6	10.4*	43.0	30.5	12.7	30.2	19.7	(4.8)	19.5	8.9	(4.0)	8.7	29.0	8.7	28.6
Other Activity	18.7	57.1*	19.8	15.0	49.6	15.6	14.3	26.1	14.5	15.9	39.8	15.7	19.6	65.5	20.3	15.7	19.8	16.2
Switched, 1973-1977	30.7	20.0*	30.5	26.6	20.0	26.5	35.2	34.5	35.2	41.6	25.3	41.3	49.3	19.2	48.6	36.1	25.6	35.9
Into Teaching				(0.3)		(0.3)	(0.1)		(0.1)		(4.8)	(0.1)				0.1*	(0.8)	0.1*
Out of Teaching							(0.1)		(0.1)	(0.3)		(0.3)		(4.0)	(0.1)	0.1*	(0.8)	0.1*
Into Research	6.7		6.5	8.8	4.3*	8.7	8.4	6.7*	8.4	7.4	(2.4)	7.3	7.8	(2.0)	7.7	8.1	4.0	8.0
Out of Research	3.6*	(9.6)	3.7*	4.9	(4.3)	4.9	13.0	13.9	13.0	18.9	13.3*	18.8	23.6	12.1*	23.3	13.1	10.9	13.1
Into Administration	7.5		7.4	6.1	12.2*	6.2	14.9	12.7	14.9	20.0	15.7*	19.9	23.0	9.1*	22.9	14.5	11.5	14.4
Out of Administration	17.3	(11.4)	17.2	13.5	(1.7)	13.3	10.3	9.7	10.3	8.5	(1.2)	8.5	7.9	(1.0)	7.7	10.8	4.8	10.7
Into Other Activity	15.1	20.0*	15.2	10.7	3.3*	10.6	11.1	15.2	11.2	13.4	(1.2)	13.1	16.7	8.1*	16.5	12.9	9.1	12.5
Out of Other Activity	8.9		8.7	7.2	13.0*	7.3	10.5	6.1*	10.4	13.2	9.6*	13.1	17.1	(2.0)	16.8	11.1	7.0	11.0

[1] Numbers shown in the table are weighted n's. Where weighted n's or percentages are based on fewer than 3 individuals, they are enclosed in parentheses; where based on 3 to 9 individuals, they are marked with an asterisk.

TABLE 5 Primary Work Activity Patterns by Ph.D. Cohort and Sex for Doctoral Scientists and Engineers Employed in U.S. Government, 1973-1977[1]

Primary Work Activity Pattern, 1973-1977	1934 to 1945			1946 to 1956			1957 to 1966			1967 to 1969			1970 to 1972			Total 1934 to 1972		
	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both
TOTAL, ALL FIELDS	244	15	259	1,660	80	1,740	2,842	134	2,976	1,600	50	1,650	1,784	69	1,852	8,130	347	8,477
Constant, 1973-1977	69.7	80.0*	70.3	73.3	77.5	73.4	73.5	75.4	73.6	71.3	60.0	70.9	63.3	76.5	63.8	70.7	78.1	70.8
Teaching				(0.2)	(3.8)	(0.4)	(0.1)	(2.2)	(0.2)	(0.7)		(0.7)				0.2*	(1.7)	0.3*
Research	23.4	13.3*	25.1	32.0	27.5*	31.8	40.7	50.7	41.1	47.3	40.0	47.1	55.1	41.2	53.4	38.5	42.1	38.6
Administration	43.4	(26.7)	42.5	38.0	30.0	37.6	29.1	18.7	28.6	18.7	20.0*	18.7	22.0	25.0*	22.1	27.7	23.1	27.5
Other Activity	(2.9)		(2.7)	3.0*	16.3*	3.6	3.6	(33.7)	3.6	4.6		4.4	6.2	10.3*	6.4	4.2	7.2*	4.3
Switched, 1973-1977	30.3	(20.0)	29.7	26.7	22.5*	26.6	26.5	24.6	26.4	28.8	40.0*	29.1	36.7	23.5*	36.2	29.3	25.9	29.2
Into Teaching				(0.4)		(0.4)	(0.2)		(0.2)	(0.5)	(4.0)	(0.6)	1.3*		1.3*	0.5*	(0.6)	0.5*
Out of Teaching				(0.3)		(0.3)	1.1*		1.1*				2.7*		2.6*	1.1		1.0
Into Research	7.0*		6.6*	8.0	13.8*	8.3	5.9	9.0*	6.1	7.7		7.5	7.2	(6.9)	7.0	7.0	7.2	7.0
Out of Research	11.9*	(20.0)	12.4*	10.4	(5.0)	10.1	12.8	6.7*	12.6	13.1	18.0*	13.5	18.6	19.1*	18.6	13.7	11.0	13.6
Into Administration	6.6*	(20.0)	7.3*	10.2		9.7	13.5	7.5*	12.3	12.9	28.0*	13.3	18.8	10.3*	18.5	13.3	9.8	13.2
Out of Administration	16.8*		15.8*	11.3	(3.8)	10.9	8.8	9.0*	8.8	9.4	(6.0)	9.3	6.8		6.5	9.2	5.2	9.0
Into Other Activity	16.8*		15.8*	8.1	(3.8)	7.9	7.0	7.5*	7.0	7.2	(8.0)	7.2	6.8	(9.8)	6.9	7.5	6.6	7.5
Out of Other Activity	(1.6)		(1.5)	1.9*	(10.0)	2.3*	2.5	6.7*	2.7	5.8	16.0*	6.1	7.8	4.4*	7.7	4.2	8.1	4.3

[1] Numbers shown in the table are weighted n's. Where weighted n's or percentages are based on fewer than 3 individuals, they are enclosed in parentheses; where based on 3 to 9 individuals, they are marked with an asterisk.

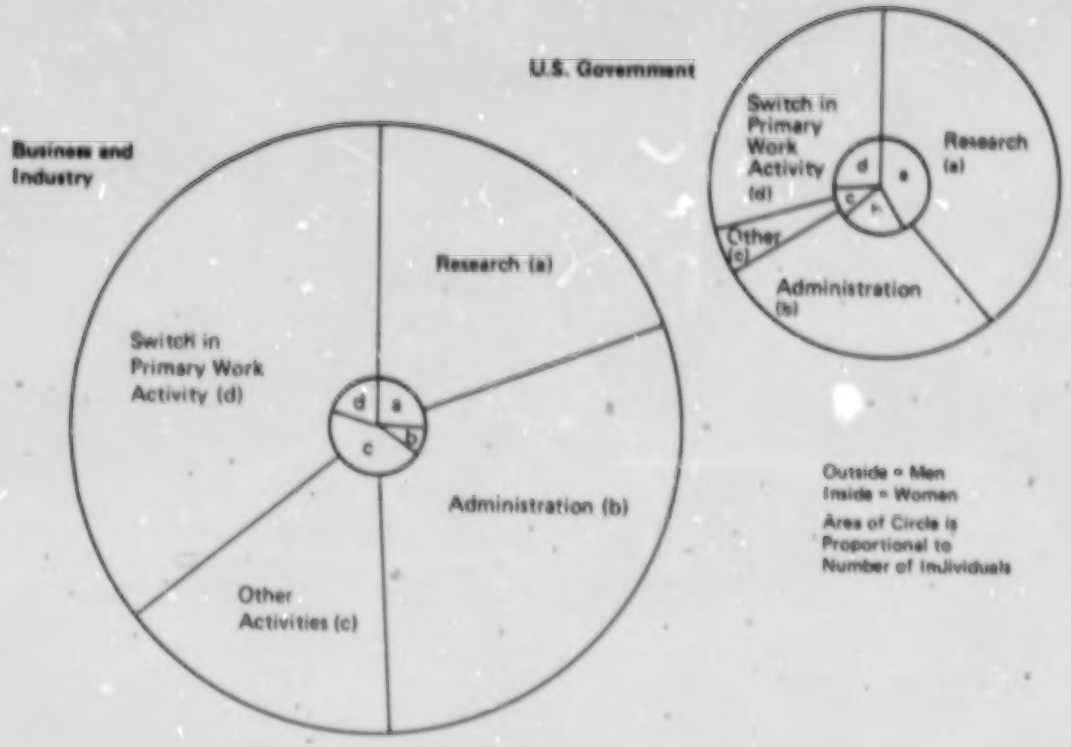
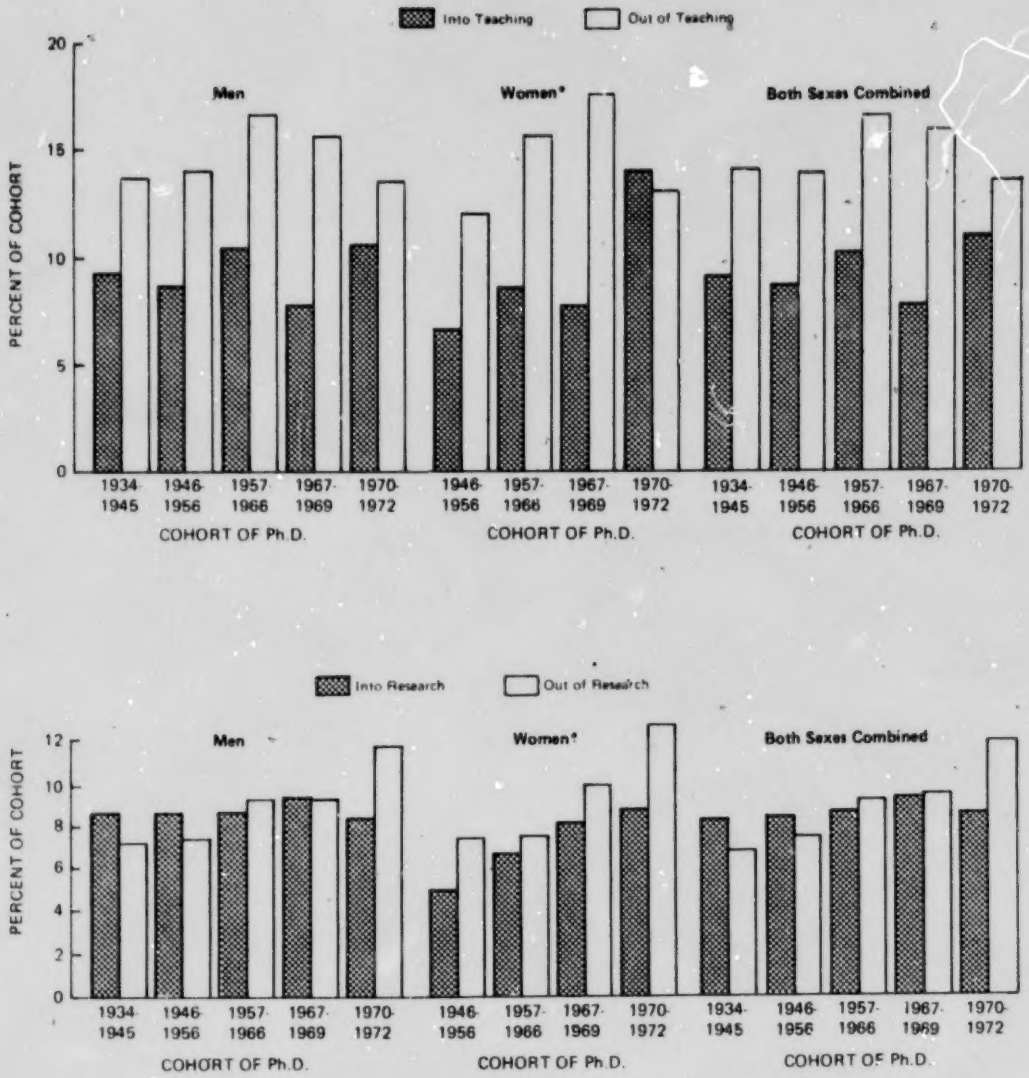


FIGURE 6 Primary Work Activity Distribution of Doctoral Scientists and Engineers Employed in Business/Industry and U.S. Government, 1973-1977

Shifts in Primary Work Activity

Data on shifts in primary work activity have been given in the bottom portions of Tables 3, 4, and 5. We turn now to examine these shifts in PWA, as shown in Figure 7 for the academic world. These shifts are only for those who remained in academe from 1973 and 1977; the more complex exploration of those who shifted employer category also is left for subsequent studies. Figure 7 shows the flux into and out of teaching and research, in terms of the proportion entering each of these activities and the proportion leaving. The data are shown separately for each sex, and for each cohort. The top of Figure 7 shows the flux in teaching. With the single exception of the 1970-1972 cohort of women, the movement out of teaching is stronger in each cohort than



*The data on women in the cohort 1934-1945 are not shown because they are based on a small number of sample cases.

FIGURE 7 Flux in Primary Work Activity for Doctoral Scientists and Engineers Employed in Academe, 1973-1977

the movement into teaching between 1973 and 1977. On the average, about 9 percent of each cohort of men move into teaching as a primary work activity, while from 13 to 16 percent move out to other primary work activities. Among the women, there are roughly twice as many leaving teaching as there are moving in, except for the most recent cohort. The data for both sexes combined resembles that for men alone, because of the predominance of men in the scientific population.

The bottom of Figure 7 shows corresponding data for the flux of scientists into and out of research. Here the movements are less spectacular, mostly varying between 7 percent and 9 percent for the men, while for the women the variation is related to cohort of doctorate, as it was for teaching. The flux is much stronger in the younger cohorts, where the movement out of research predominates. As for teaching, the combined-sex data resemble those for men.

Flux by Field Groups

Figures 8, 9, and 10 show similar data for three field groups separately. For simplicity of presentation, only the net movement into or out of each of the primary work activities is shown--here including administration and "other" activities as well as teaching and research. Figure 8 shows the data for the EMP fields, Figure 9 for the life sciences, and Figure 10 for the behavioral sciences.

Net Movement in EMP Fields

Figure 8 shows the strong net movement out of teaching and into administration in the EMP fields. The oldest cohort shows, for men, a movement out of administration as well as teaching, and into research and other activities. There are too few women in this cohort to provide reliable data. The same is true of administration in the second cohort; women are relatively rare in the EMP fields, and particularly so in administration, where only in cohort 3 are there enough to show a distinct movement into administrative work. The net movement for all cohorts combined is shown at the right in each portion of the chart; the net flux is greater for men than for women in both teaching and administration, while there is a small and probably insignificant

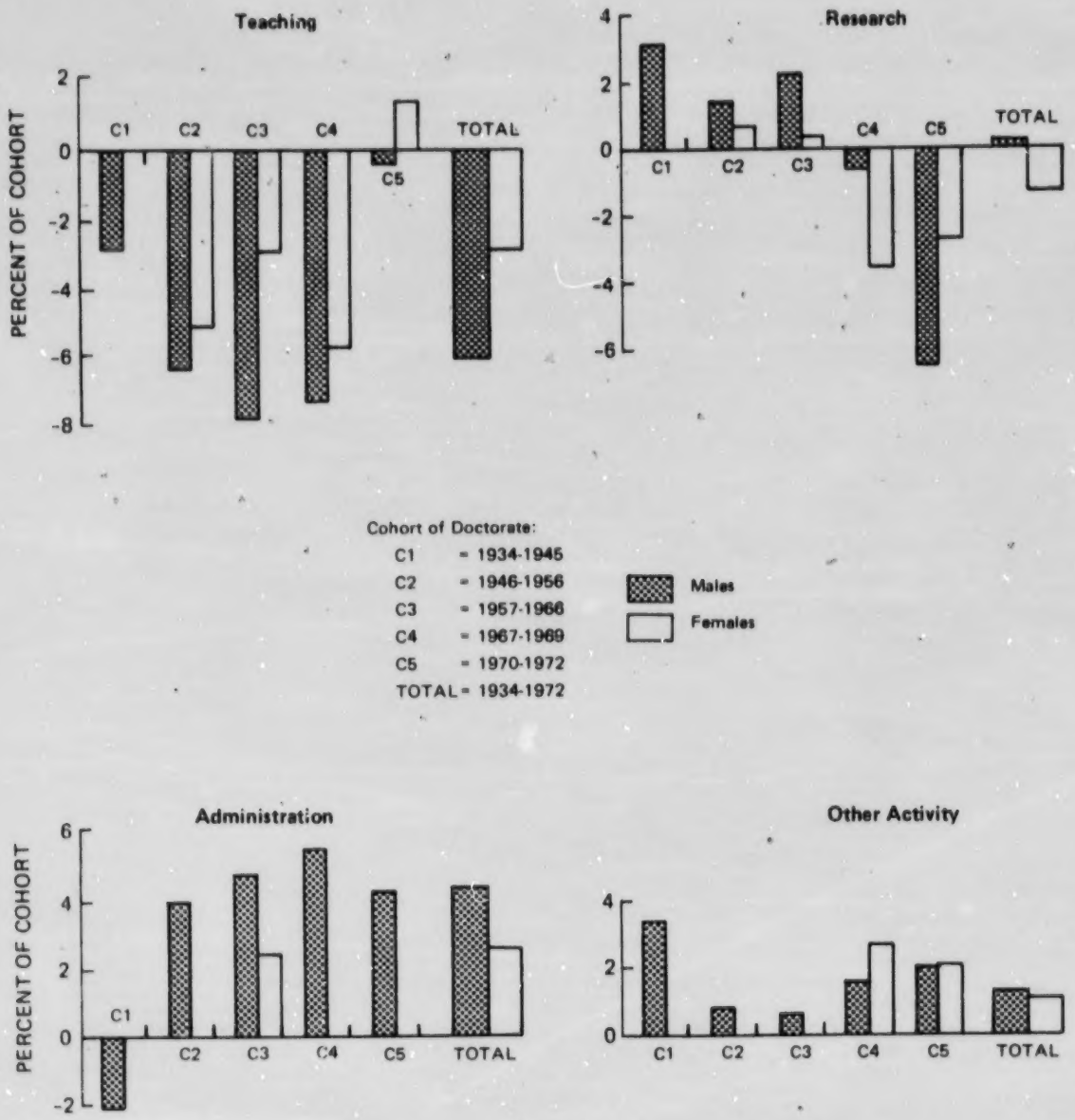


FIGURE 8 Net Changes* in Primary Work Activity by Sex and Ph.D. Cohort for Doctoral Scientists and Engineers Employed in Academe, 1973-1977, EMP FIELDS

*Net changes are not presented when data from 1973 and/or 1977 are based on less than 3 individuals.

difference in research and other activity. For the youngest cohort, there is little net change for either men or women with respect to teaching, and a net movement out of research for both. There is a general tendency toward a net movement out of research that varies systematically by cohort--the older men, particularly, moving into research while the younger men are moving out. Whether this represents a tightening of the resources for research, combined with fewer students to teach, so that the research funds are differentially shifted to older faculty members, cannot be ascertained from these data alone, but the evidence is sufficient to suggest that other sources be tapped to determine whether this is true or not. With respect to work activities other than teaching, research, and administration, there is a small net flux, in the positive direction, for all cohorts of men, and for the most recent cohort of women, one cohort where women are in sufficient numbers to justify graphic representation.

Net Movement in the Life Sciences

Figure 9 shows the corresponding data for the life sciences, and the trends are similar with respect to a movement out of teaching and into administration, as well as a trend out of research for the more recent cohorts. The trend toward other activities is positive in all cohorts, and a bit stronger than in the case of the EMP fields. As with the EMP fields, the number of women is too small in the early cohorts to provide reliable statistics; in the recent cohorts, the flux of women into and out of activities is similar to that for men, but is much stronger in terms of the proportion of the total population of women.

Flux in the Behavioral Sciences

The behavioral sciences are shown in Figure 10. Here the net trend out of teaching is far stronger than in the natural sciences, and the movement into administration is much stronger. The movement out of teaching characterizes both sexes and all cohorts. The flux into administration is similarly pervasive except that, for the earliest cohort there are too few women to provide reliable data. The trend with respect to research is much less pronounced, with no consistent time trends or sex differences. The movement into other

activities is roughly similar to that in the natural sciences, being positive in most cohorts and for both sexes.

Caveat

It should perhaps be restated here that all of the foregoing, with respect to Figures 7 through 10, refers only to those who were in academic work in both 1973 and 1977. This is the largest group in the scientific-technical Ph.D. population, and the only one in which teaching is a sufficiently prevalent activity to provide meaningful data on shifts in primary work activity. In business/industry and U.S. government, there are some persons for whom teaching is a primary work activity, but they are relatively rare. Thus, for those who move into or out of academe, a change in proportion doing teaching would be expected.

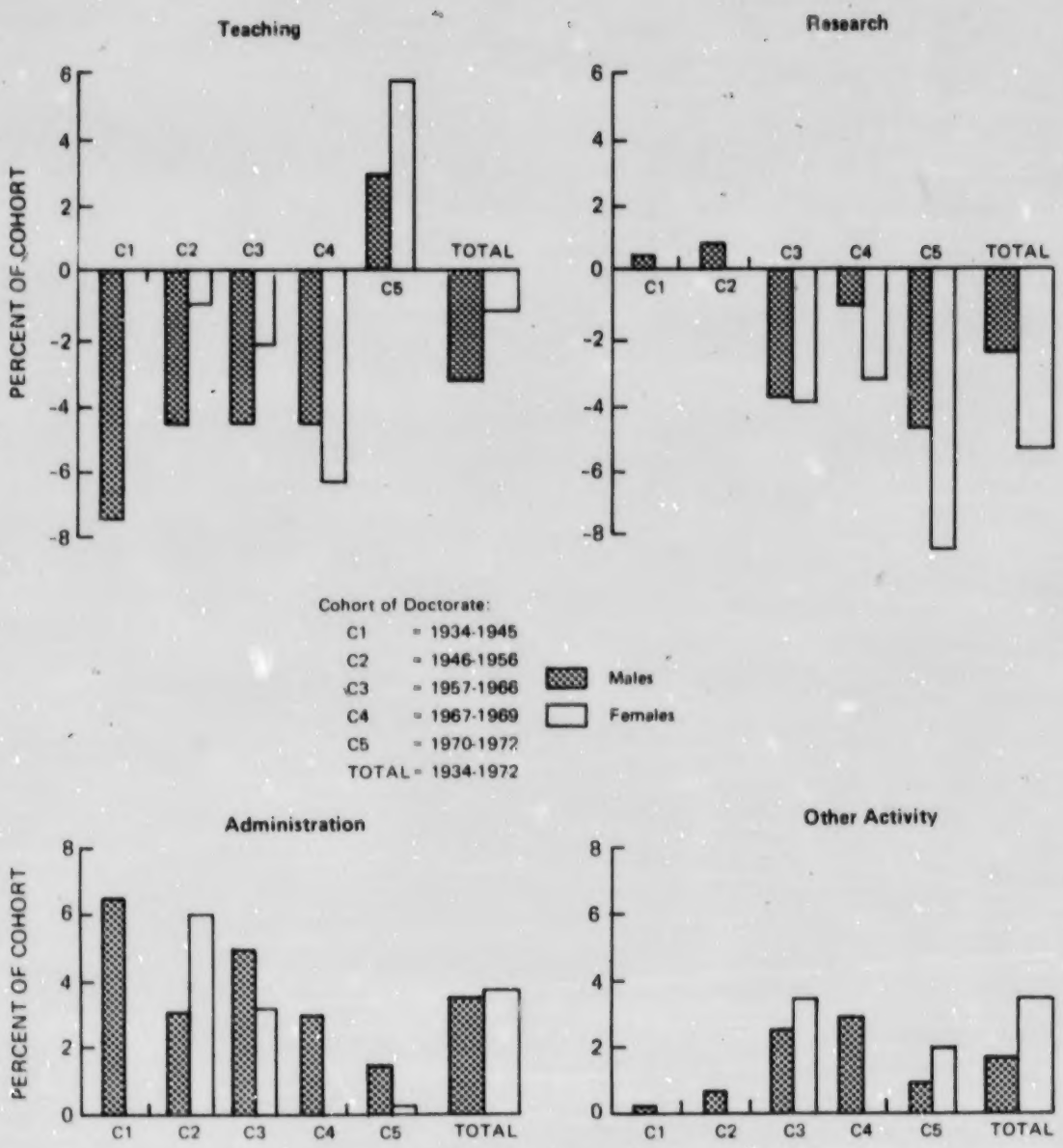


FIGURE 9 Net Changes* in Primary Work Activity by Sex and Ph.D. Cohort for Doctoral Scientists and Engineers Employed in Academe, 1973-1977, LIFE SCIENCES

*Net changes are not presented when data from 1973 and/or 1977 are based on less than 3 individuals.

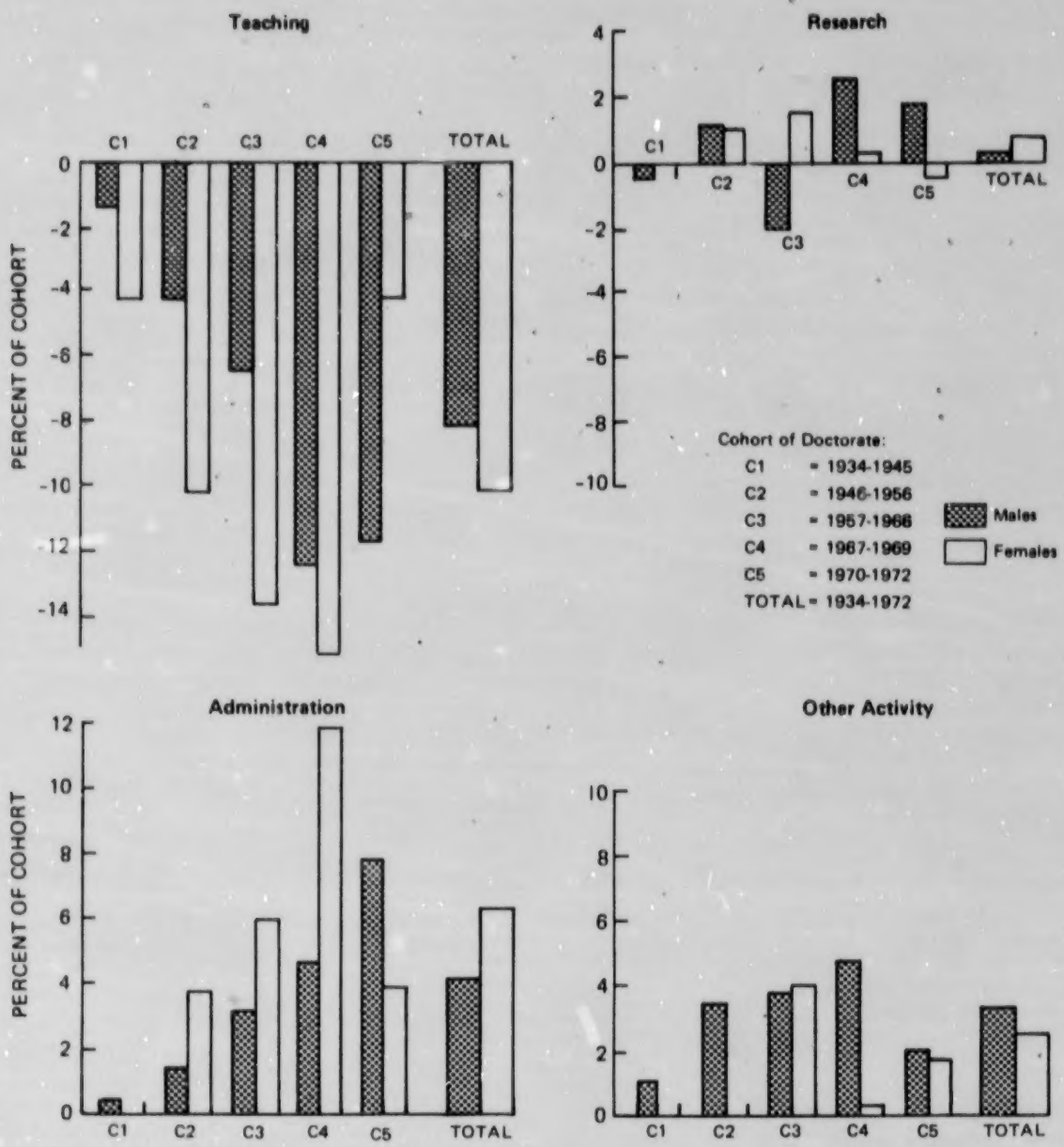


FIGURE 10 Net Changes* in Primary Work Activity by Sex and Ph.D. Cohort for Doctoral Scientists and Engineers Employed in Academe, 1973-1977, BEHAVIORAL SCIENCES

*Net changes are not presented when data from 1973 and/or 1977 are based on less than 3 individuals.

CHAPTER 3

PLANS AT PH.D.: FORESHADOWS OF COMING EVENTS

In the preceding chapters, we have seen something of the employer categories of the science and engineering Ph.D.'s, and of their primary work activities, and a little about shifts in these categories of employment and work activity. In this chapter, we will examine some data relating to the extent to which the employer categories of 1973-1977 were foreshadowed by the plans the Ph.D.'s had at the time of graduation. In this chapter, we will shift the definition of graduation cohorts, because, prior to 1957, there was no Survey of Earned Doctorates questionnaire which gathered the relevant information. This chapter will therefore deal with the Ph.D.'s of 1957 and later, divided into categories which provide maximum definition of the more recent cohorts.

The Survey of Earned Doctorates: Plans for Future Explored

In the Survey of Earned Doctorates each Ph.D. has been asked at the time of graduation about his or her plans for postdoctoral study or employment (among other things). In earlier studies those plans have been found to constitute good predictors, for a period of up to 5 years following graduation, of the actual activities of these people.[1] In the present study a slightly different approach is used, and new cohorts have been followed up, some of them over a much longer period of time--up to 20 years.

A Generalization on Validity of Plans

There is a generalization that stands out from the present study, with

---

[1] Mobility of Ph.D.'s, Before and After the Doctorate, NAS, Washington, D.C. 1971. Chapter 5 of this report includes data on agreement of plans and actualities.

respect to the relation of plans to later actuality, which is that in all cohorts and in all fields within each cohort (except where the numbers of cases are too small for reliable statistics) the 1973-1977 employer category is foreshadowed by the plans at Ph.D. A plurality within each employer category in 1973 and 1977 had chosen that category before filling out the Survey of Earned Doctorates form at the time of graduation--which,for the oldest cases was 20 years prior to the Survey of Doctorate Recipients in 1977. In most cases, that plurality was an absolute majority, and frequently a very large majority. This generalization is examined in some detail in the paragraphs to follow, and variations on the degree of agreement between plans and eventual employer category are shown.

Overall Plans

The most general overall trend of these data is shown in Table 6, which includes data for men only. Data for women are somewhat different, and because of the smaller number of cases, the percentages are somewhat less reliable. In Table 6 we see the percent of persons in each 1973-1977 employer category who had chosen that category at the time of Ph.D. graduation, as shown by the Survey of Earned Doctorates at that time. All fields are combined, and the three graduation cohorts are shown. These same cohorts will be used throughout the rest of this report.

TABLE 6 Percent of Male Doctoral Scientists and Engineers by Employer Category and Ph.D. Cohort, Who Had Expressed Same Choice of Employer Category on the Survey of Earned Doctorates at the Time of Graduation

Employer Category, 1973-1977	Percent Who Had Chosen this Category at Graduation		
	1957-1966	1967-1969	1970-1972
Academe	60.6	65.1	67.2
Business/Industry	60.4	70.2	72.5
U.S. Government	38.6	49.2	48.0
All Other Employers	42.1	37.3	56.6

Academic Employment

To get a more detailed picture, Table 7 presents the data for men in academic employment only, by field groups. It shows the field groups in rows, one row for each cohort of doctorate. The first column gives the actual number of individuals in the sample (not the weighted N) in order to indicate the reliability of the percentages that follow. Reading across each row one finds the percent of the individuals in that field and cohort who had chosen each of the post-graduation plan options shown by the columns. These percentages are based on the weighted N's, which provide the most accurate estimate of the distribution of the population. For example, reading across the first row, we see, in Total, All Fields, 1957-1966, that 14.6 percent of those now in academic employment had planned postdoctoral study, while 60.6 percent had planned immediate academic employment. The other available plan options, across to the final entry of 8.2 percent with plans unknown, are given for comparison. It should be noted that this 8.2 percent with plans unknown is unusually high because, during the first months of calendar year 1957 the Survey of Earned Doctorates form was not in universal use. That was the year the questionnaire survey began.

TABLE 7 Plans at Ph.D. by Field Group and Cohort of Doctorate for Male Doctoral Scientists and Engineers Employed in Academe, 1973-1977

Field Group and Cohort of Doctorate	Sample Number	Plans at Ph.D.						
		Post-Doct. Study	Employment				Other Plans, Including Military Svc.	Plans Unknown*
			Academe	Business/ Industry	U.S. Government	Other or Unknown		
TOTAL, ALL FIELDS								
1957-1966	4,100	14.6	60.6	6.0	2.6	6.5	1.6	8.2
1967-1969	1,842	21.5	65.1	2.8	1.2	5.0	1.8	2.6
1970-1972	1,777	23.7	67.2	1.6	0.6	3.0	0.7	3.1
EMP Fields								
1957-1966	1,805	14.4	57.2	10.8	2.1	5.4	1.7	8.3
1967-1969	791	20.2	63.4	4.9	1.7	5.4	2.1	2.4
1970-1972	653	27.4	63.4	2.9	1.0	2.9	0.5	1.9
Life Sciences								
1957-1966	1,354	22.4	55.3	2.2	3.1	7.4	1.2	8.4
1967-1969	627	37.1	50.4	1.6	1.3	4.6	2.1	2.9
1970-1972	624	37.3	54.2	1.2	0.0	2.3	0.9	4.1
Behavioral Sciences								
1957-1966	941	5.7	73.0	1.6	3.1	7.3	1.6	7.8
1967-1969	424	6.2	84.6	0.5	0.5	4.6	1.2	2.5
1970-1972	500	6.9	83.7	0.6	0.6	3.9	0.8	3.5

*In 1957-1966 the "plans unknown" figure is inflated because the Survey of Earned Doctorates form was not universally in use during the early months of 1957.

Postdoctoral Training

It is noteworthy that in Table 7 the percentage of men planning postdoctoral study is higher than the percentage in any defined nonacademic category of employment. In only one cohort of one field (Behavioral Sciences, 1957-1966) is there an exception, and that is with respect to "Employer Category Unknown". Even here the difference may not be reliable, as it is based on a very small number of cases. The association of plans for postdoctoral training with employment in academe is noteworthy, although examination of those in other categories of present employment is required to determine whether it is unique.

A few additional observations with respect to Table 7 are worthy of note. The percentage planning immediate academic employment is far higher in the behavioral science group than in either of the other groups. Yet the combined percentages of those planning academic employment and postdoctoral training are much more nearly constant across fields, although they do vary systematically by cohort. The percentage of those in academe in 1973 and 1977 who had planned to enter business and industrial employment, while never large, was distinctly higher in the EMP fields, suggesting that there has been more switching of employer categories here (business and industry to academe) than in the other fields.

Business and Industrial Employment

Table 8 provides corresponding data for those men who were employed in the business and industrial sector in 1973-1977. It is interesting to note that the degree of agreement with the present employer category in Table 8 tends to be higher in the EMP and life sciences fields than it was in the academically employed table, but lower in the case of the behavioral science fields. In the behavioral sciences 1957-1966, where the correspondence of plans at Ph.D. with later employment is least (32.8 percent), the nearest competitor is not another employer category, but the "other and unknown" category that includes non-profit organizations. Within this business/industry group, the percentage that, at Ph.D. graduation, had planned postdoctoral training is roughly half as large as the percentages shown in Table 7 for the academically employed group. This tends to confirm the observation that postdoctoral training is

primarily training for academic employment. (In these tables those Ph.D.'s planning to be self-employed are included under business/industry employment plans at Ph.D. to correspond with the definitions used in the Survey of Doctorate Recipients.)

TABLE 8 Plans at Ph.D. by Field Group and Cohort of Doctorate for Male Doctoral Scientists and Engineers Employed in Business/Industry, 1973-1977

Field Group and Cohort of Doctorate	Sample Number	Plans at Ph.D.						
		Post-Doct. Study	Employment				Other Plans, Including Military Svc.	Plans Unknown*
			Academe	Business/ Industry	U.S. Government	Other or Unknown		
TOTAL, ALL FIELDS								
1957-1966	1,523	7.4	9.7	60.4	2.6	9.0	2.3	8.6
1967-1969	731	12.5	6.4	70.2	0.9	5.3	2.4	2.3
1970-1972	565	11.6	4.8	72.5	1.2	5.9	2.2	1.8
EMP Fields								
1957-1966	1,158	7.4	8.2	64.4	1.6	7.2	2.2	8.9
1967-1969	590	11.5	4.9	73.4	0.9	4.8	2.4	2.2
1970-1972	458	11.0	3.4	75.0	1.5	5.0	2.0	2.1
Life Sciences								
1957-1966	281	9.6	15.5	49.5	4.7	11.8	2.2	6.6
1967-1969	104	24.2	11.3	54.6	0.6	5.3	2.3	1.6
1970-1972	80	18.2	11.0	62.1	0.0	6.0	2.6	0.0
Behavioral Sciences								
1957-1966	84	2.1	15.9	32.8	9.6	27.8	2.9	8.8
1967-1969	37	5.0	21.4	48.7	2.5	13.4	2.5	6.3
1970-1972	28	7.1	14.6	53.0	0.0	21.2	4.0	0.0

*In 1957-1966 the "plans unknown" figure is inflated because the Survey of Earned Doctorates form was not universally in use during the early months of 1957.

U.S. Government Employment

The degree of agreement between plans at Ph.D. and 1973-1977 employment by the U.S. government, shown in Table 9, is lower than in the preceding tables, except in the life sciences. For many years, the National Institutes of Health and the Department of Agriculture have employed many life scientists; it has come to be a frequently expected career pattern, as business and industry are in the EMP fields. In the latter, the degree of agreement between plans and actuality is much less distinct for those now employed by the U.S. government. However, with the one exception of the behavioral sciences in 1967-1969, it is still the most frequent pattern.

Military Service Combined with Other Government Service

A distinctive feature of Table 9 is the percentage of scientists in the

column "Other Plans, Including Military Service". This percentage is far higher than in the preceding tables, typically four to ten times higher. The obvious reason is that both civilian and military service are government employment, although they are separated in the Survey of Earned Doctorates (the DRF data). If they are considered together, the combined percentages resemble the degree of agreement shown in Tables 7 and 8 between employment in 1973-1977 and plans at Ph.D.

TABLE 9 Plans at Ph.D. by Field Group and Cohort of Doctorate for Male Doctoral Scientists and Engineers Employed in U.S. Government, 1973-1977

Field Group and Cohort of Doctorate	Sample Number	Plans at Ph.D.						
		Post-Doct Study	Employment				Other Plans, Including Military Svc.	Plans Unknown*
			Academe	Business/ Industry	U.S. Government	Other or Unknown		
TOTAL, ALL FIELDS								
1957-1966	520	9.3	15.9	8.7	38.6	9.8	8.8	9.0
1967-1969	267	11.1	10.0	8.9	49.2	5.9	13.0	1.9
1970-1972	268	11.6	6.0	4.3	48.0	5.7	20.3	4.0
EMP Fields								
1957-1966	241	8.9	13.6	15.6	36.1	6.1	12.6	7.1
1967-1969	128	12.6	6.5	15.8	40.4	4.3	17.2	3.2
1970-1972	149	11.8	5.6	5.9	42.3	5.7	24.7	4.1
Life Sciences								
1957-1966	215	13.2	15.4	1.8	45.0	12.6	3.6	8.4
1967-1969	113	12.4	4.9	0.0	57.0	8.8	6.2	0.7
1970-1972	97	12.9	4.4	1.7	60.9	7.3	7.9	4.9
Behavioral Sciences								
1957-1966	64	0.0	25.0	3.3	29.5	15.2	9.8	17.2
1967-1969	26	0.0	42.5	3.9	34.8	3.9	14.6	0.0
1970-1972	22	5.2	15.0	3.3	39.2	0.0	37.3	0.0

*In 1957-1966 the "plans unknown" figure is inflated because the Survey of Earned Doctorates form was not universally in use during the early months of 1957.

Other Employer Categories

Tables 7, 8, and 9 have provided data regarding agreement of plans and the subsequent experience of actual employment categories. There is, however, another category, rather diffuse and vague, entitled "other employers". This group is chiefly non-profit organizations, including schools and hospitals as well as any miscellaneous employers that do not fit in the clearly-defined set. It is interesting to look at those who are now employed in this group to see what their plans were at the time of Ph.D. graduation. Table 10 provides the data in the same format as in the preceding tables.

Rather surprisingly, perhaps, the generalization that applied to the distinct employer categories still holds for the diffuse "other employer" category,

although less strongly. For those in this category, plans at Ph.D. were, in a plurality of cases sometimes amounting to a majority, in the "other and unknown" category also. This is especially true for the behavioral scientists, substantial numbers of whom are employed in nonprofit organizations, schools, and hospitals. It is noteworthy, in addition, that the numbers of cases in Table 10 are much smaller than in the major employer groups. The percentages are therefore less reliable, which makes the observed degree of agreement all the more remarkable, as unreliability of data tends to erode whatever underlying pattern there might be.

TABLE 10 Plans at Ph.D. by Field Group and Cohort of Doctorate for Male Doctoral Scientists and Engineers Employed in "Other Employer Categories," 1973-1977

Field Group and Cohort of Doctorate	Sample Number	Plans at Ph.D.						
		Post-Doct. Study	Employment				Other Plans, Including Military Svc.	Plans Unknown*
			Academe	Business/ Industry	U.S. Government	Other or Unknown		
TOTAL, ALL FIELDS								
1957-1966	373	13.1	16.3	9.4	7.4	42.1	1.1	10.6
1967-1969	170	22.5	19.7	11.9	4.3	37.3	3.7	0.6
1970-1972	217	18.3	8.9	7.9	3.1	56.6	1.7	3.6
EMP Fields								
1957-1966	122	13.2	17.4	20.6	5.8	32.2	1.6	9.1
1967-1969	63	27.2	12.1	23.8	5.6	29.1	2.2	0.0
1970-1972	63	19.8	3.0	17.7	4.5	49.8	3.4	1.8
Life Sciences								
1957-1966	126	22.9	20.3	3.7	1.5	40.0	0.6	11.2
1967-1969	49	44.5	21.0	3.1	3.5	21.0	7.0	0.0
1970-1972	69	36.3	8.3	2.4	2.7	43.8	2.4	4.2
Behavioral Sciences								
1957-1966	125	6.0	12.5	3.2	13.0	52.8	0.9	11.5
1967-1969	58	3.3	27.5	4.1	3.3	56.9	3.3	1.6
1970-1972	85	7.2	13.5	3.7	2.2	68.8	0.0	4.7

*In 1957-1966 the "plans unknown" figure is inflated because the Survey of Earned Doctorates form was not universally in use during the early months of 1957.

Agreement on Other Items

It would be possible to determine the degree of agreement between plans at Ph.D. and later actuality on items in addition to employer category. For example, the primary work activity anticipated is available for several years of doctorate graduation. Further details regarding fields, and possibly a finer set of cohort categories, might provide additional useful information. It would be interesting to determine whether the degree of confidence the new Ph.D. had in his plans at the time he completed the Survey of Earned Doctorates (this is in the Doctorate Records File) has any bearing on the degree of subsequent agreement. All of these possibilities, however, are left for examini-

nation in later studies. We turn, therefore, to an additional and very interesting aspect of career patterns, that of income, in the next chapter. The cohorts used in this chapter will be employed there, for the sake of continuity and to provide greater detail on the most recent graduates, regarding whom the uncertainties are greatest.

CHAPTER 4

SALARY PATTERNS OF PH.D. SCIENTISTS AND ENGINEERS

In 1973, the full-time employed U.S. scientist or engineer with a doctorate earned a median salary of $20,890. In 1977, the median salary was $25,600, for a four-year increment of 22.5 percent, as compared with a cost of living increase of 43.1 percent over the same period.[2] These data, taken from the 1973 and 1977 Profile reports[3] convey only a meager picture of salaries and salary changes, however, and require some amplification to take on important meaning. As we examine how salaries are related to such factors as field of doctorate, cohort of graduation, employer category, primary work activity, and sex, a pattern emerges that has a great deal of interest for scholars, administrators, and for the scientists themselves. Within this brief report, only a short glimpse can be afforded of the richness of the variation of these patterns, but even this glimpse is sufficient to reveal some hitherto unknown facts.

A good way to begin is to consider salary variations, in 1973 and 1977

TABLE 11 1973 and 1977 Salary Variations by Ph.D. Cohort for Full-time Employed Male Doctoral Scientists and Engineers

	1957-1966		1967-1969		1970-1972	
Salary Statistic	1973	1977	1973	1977	1973	1977
Mean (from grouped data)	$22,830	$30,890	$18,670	$26,290	$16,360	$23,620
Standard Deviation	6,790	10,150	4,500	7,520	4,510	6,490
25th Percentile	18,870	24,950	16,100	21,910	13,720	19,490
50th Percentile (Median)	21,850	29,270	18,380	25,200	16,310	22,660
75th Percentile	25,430	34,170	21,080	29,800	18,680	26,580

[2] Bureau of Labor Statistics, Consumer Price Index, Feb. 1973 vs. Feb. 1977.
[3] National Research Council, Commission on Human Resources, Doctoral Scientists and Engineers in the United States: 1973 Profile, (Washington, D.C.: National Academy of Sciences, 1974); 1977 Profile, NAS, 1978.

salaries, for three cohorts of doctorate, and consider not just the median, but other measures such as the mean, the standard deviation, and several percentile points. These data are given in Table 11, for male scientists only. The cohorts of Ph.D. are the same as those in Chapter 3.

TABLE 12 1973 and 1977 Mean Salaries of Full-time Employed Doctoral Scientists and Engineers by Field Group, Sex, and Ph.D. Cohort

	Total, All Fields		EMP Fields		Life Sciences		Behavioral Sciences	
Cohort of Ph.D.	Men	Women	Men	Women	Men	Women	Men	Women
1973								
1957-1966	$22,690	$19,060	$23,020	$18,360	$21,420	$18,380	$23,420	$20,050
1967-1969	18,730	16,000	19,190	15,320	17,520	15,220	18,900	16,980
1970-1972	16,610	14,820	17,060	14,380	15,650	13,700	16,620	15,560
1977								
1957-1966	30,310	25,020	31,100	24,560	28,640	24,350	30,300	25,880
1967-1969	26,010	22,090	26,800	21,430	24,600	21,620	25,480	22,780
1970-1972	23,470	20,420	24,280	20,140	22,290	19,740	23,060	20,970

Salary Variations by Field Group, Cohort, and Sex

Table 11, controlling for cohort and sex, shows some of the salary variation within each of these groups. A more meaningful picture emerges as we consider other variables. For example, in Table 12, mean salaries are shown by sex, by field group, and by cohort, for 1973 and 1977. The sex differential is prominent in these data: men's salaries exceed those of women by up to 25 percent in the EMP fields and 17 percent in the life sciences and behavioral sciences. The differentials were diminished but little from 1973 to 1977. Also, salary levels are typically highest in the EMP fields and lowest in the life sciences.

Employer Category and Work Activity Affect Salary

Table 13 shows further sources of variability, as the factors of employer category and primary work activity are introduced, for men only, but combining all fields of doctorate. In the rows in Table 13, it will be noted that, following the total for all categories of primary work activity, data are shown for teaching (for the academic sector only), research, administration, and all other activities, for those whose primary work activity remained unchanged from 1973 to 1977, and also for those who shifted, over this 4-year period, from

teaching to administration, from research to administration, and for all other categories of switching combined. Data are given for men for all three graduation cohorts. Data for women are omitted at this point, for reasons of simplification, and because sex differences are dealt with more explicitly in the following section.

TABLE 13 1973 and 1977 Mean Salaries of Full-time Employed Male Doctoral Scientists and Engineers by Employer Category, Primary Work Activity,* and Ph.D. Cohort

Primary Work Activity Pattern by Ph.D. Cohort, 1973-1977	Employer Category and Year							
	Academe		Business/Industry		U.S. Government		Other	
	1973	1977	1973	1977	1973	1977	1973	1977
1957-1966 Ph.D.'s	$21,110	$27,770	$25,710	$35,630	$25,260	$33,430	$22,620	$29,650
Constant, 1973-1977								
Teaching	20,120	26,050	–	–	–	–	–	–
Research	20,170	28,230	22,850	31,510	22,870	30,460	21,160	28,130
Administration	25,840	33,450	28,990	41,320	28,620	37,530	26,180	34,260
Other Activity	19,940	26,660	25,450	33,850	26,580	34,340	20,990	27,920
Switched, 1973-1977								
Tch. to Admin.	21,950	30,420	–	–	–	–	–	–
Res. to Admin.	22,050	32,190	22,910	33,400	24,130	32,990	21,010	26,850
Other Switches	21,580	28,170	25,080	33,810	25,930	33,990	20,980	27,160
1967-1969 Ph.D.'s	17,220	23,340	21,440	31,130	21,290	29,210	18,350	25,840
Constant, 1973-1977								
Teaching	16,960	22,670	–	–	–	–	–	–
Research	16,800	23,330	20,440	29,020	20,480	27,910	17,080	25,040
Administration	21,320	29,100	23,690	36,030	24,870	34,730	19,430	27,830
Other Activity	17,260	23,960	21,800	31,030	20,600	27,380	19,680	25,610
Switched, 1973-1977								
Tch. to Admin.	18,170	26,100	–	–	–	–	–	–
Res. to Admin.	19,400	27,710	20,970	31,290	21,590	30,270	20,020	27,550
Other Switches	17,150	23,060	20,810	29,730	20,740	28,010	18,100	25,970
1970-1972 Ph.D.'s	15,270	21,060	18,940	28,180	18,650	26,900	17,690	25,470
Constant, 1973-1977								
Teaching	15,360	20,840	–	–	–	–	–	–
Research	14,480	20,690	18,370	26,450	18,050	25,550	16,340	24,170
Administration	20,700	27,430	21,280	32,840	20,220	30,200	19,460	28,260
Other Activity	15,160	20,550	18,950	27,990	16,910	24,620	17,290	24,640
Switched, 1973-1977								
Tch. to Admin.	16,070	23,720	–	–	–	–	–	–
Res. to Admin.	16,030	24,350	18,270	28,640	18,910	27,930	18,380	26,250
Other Switches	14,830	20,660	18,910	28,040	18,860	26,920	17,960	25,690

*Teaching was too infrequent as a primary work activity in other than academe to provide reliable statistics.

Salary Increments, 1973 to 1977

We have seen in the preceding pages that salaries have varied by field, by sex, by cohort, by employer category, and by primary work activity. There remains the vital matter of salary increments over this 4-year span. An individual may be only vaguely aware of his salary relative to that of others,

but is usually acutely aware of his own salary increments, and how this change relates to the change in the cost of living. This question is approached here by comparing the increments in mean salaries for groups of people who remained in the same employer categories from 1973 to 1977, by field of doctorate, cohort, and sex. It is further detailed by primary work activity (PWA) for those who had the same PWA in both years, and for those who made particular types of switches. Table 14 provides incremental data [(1977 salary mean divided by 1973 salary mean, minus 1.00) x 100] for men and women, by field group, employer category, and cohort of Ph.D. Compared with the median salaries quoted earlier, it should be noted that the data in Table 14 are for the same individuals in 1973 and 1977, whereas the medians quoted on page 35 are for all employed Ph.D.'s in each period; there were new entrants at the lower end of the salary scale, and losses principally at the higher end of the scale between 1973 and 1977.

TABLE 14 Percentage Salary Increments[1] of Full-time Employed Doctoral Scientists and Engineers by Sex, Field Group, Ph.D. Cohort, and Employer Category, 1973-1977

Constant Employer Category, 1973-1977	Total, All Fields		EMP Fields		Life Sciences		Behavioral Sciences	
	Men	Women	Men	Women	Men	Women	Men	Women
1957-1966 Ph.D.'s								
Total	36.5	35.0	38.1	42.1	36.5	34.7	32.2	31.8
Academe	35.0	34.1	37.0	41.8	35.6	33.4	30.4	31.4
Business/Industry	40.8	46.5	40.8	49.3*	44.7	38.8*	31.5	53.1*
U.S. Government	33.4	35.0	33.5	36.7*	34.4	35.9	29.9	30.1*
Other	39.0	33.8	36.2	35.0*	31.2	41.4*	46.8	29.4
1967-1969 Ph.D.'s								
Total	40.7	45.5	40.2	61.1	46.0	47.1	35.5	35.3
Academe	37.5	43.7	36.6	53.6	41.1	46.5	35.0	37.3
Business/Industry	48.2	53.7	44.3	55.3	82.7	(51.0)	44.9	(51.6)
U.S. Government	38.4	113.7*	39.9	(247.8)	37.3	(43.5)	35.3	(38.8)
Other	42.1	34.1	44.2	(44.1)	52.0	50.8*	33.4	18.8*
1970-1972 Ph.D.'s								
Total	47.0	47.1	46.5	58.0	49.8	64.3	45.6	34.9
Academe	43.7	48.3	40.7	63.6	45.2	67.5	46.0	32.7
Business/Industry	55.9	53.3	53.4	45.3*	[illegible]	(40.3)	46.7	70.5*
U.S. Government	46.8	45.7*	45.7	(47.3)	47.2	47.2*	52.4	(38.7)
Other	46.4	38.5	48.0	(33.4)	52.9	52.8*	42.0	36.7

[1] Increments based on fewer than 60 sample individuals are marked with an asterisk; those based on n's of 19 or less are shown in parentheses. Because of the relatively small n's, these increments are less reliably determined.

Increments Vary by Cohort, Employer Category, Sex, and Field

An examination of Table 14 shows that, across all fields and employer categories, the salary increments for the older cohort (1957-1966) for men and women are very nearly the same (36.5 percent increase for men vs. 35.0 percent for women) over the 4-year period. For the 1967-1969 cohort, women gained somewhat more, relative to their 1973 salaries (45.5 percent vs. 40.7 percent for the men) and in the youngest cohort (1970-1972) the gains were almost identical (47.0 percent vs. 47.1 percent). These generalized results, however, need to be analyzed further. Considered by field and employer category, there are significant differences. Women tended to gain more, proportionately, than men in the EMP fields--in other words, the consistent gap in average salaries was diminished somewhat for the major employer categories, academe and business/industry. In U.S. government employment this appears to be true also, but the smaller number of cases renders the data less reliable. In the miscellaneous "all other" category, the differences are unreliable, but the men seem to have fared better.

Increments in the Life Sciences

In the life sciences, the trends are very mixed. In the academic world, where the numbers are large enough for reliable data, the older women gained less than their male contemporaries, but the younger women (cohorts 1967 through 1972) gained more. In other sectors, the data are mixed and differences are not reliably established.

Behavioral Sciences Show a Different Pattern

These trends in the natural sciences, where men have historically predominated, do not hold in the behavioral sciences, where there has been a better sex balance. In the academic world, the two older cohorts of women gained slightly more than did the men, but the differences are too small to be of any practical importance. In the 1970-1972 cohort, the gains for women in academic life were smaller than the gains for men. In the business/industry sector, the women made distinctly larger gains in all three cohorts, while in the U.S. government the differences are small, mixed, and of doubtful significance. In the miscellaneous "all other" employer category, women had smaller salary

increments than men in all three cohorts. The very heterogeneous nature of this category makes interpretation hazardous.

Work Activity and Salary Increments

There remains the matter of salary increments as they relate to primary work activity, and changes in PWA. We have seen salary differentials for men (Table 13) from this standpoint; in general, they favored those in administration, as expected. What are the trends with regard to salary increments? The relevant data for men are shown in Table 15. In these analyses, increments based on fewer than 12 cases have been omitted as too unreliable. This has the effect of cutting out one PWA/employer category data entirely (non-academic teaching). The "all fields combined" data have been eliminated here, because it is apparent that the significant information is to be found in the separate field group data.

The first data column in Table 15 shows the increments for all patterns combined, and this is redundant on Table 14, but in a different arrangement. The main information in this column, aside from serving as a frame of reference, is to be found in comparing cohorts, holding constant field and employer category. The younger cohorts usually gain more, in percentage terms, than the older ones. This is a finding that confirms data from the 1935-1963 period, as shown in Career Patterns Report #2,[4] Chapter 2.

The salary increments for men who remained in teaching are shown in column 2 of Table 15. Here we are concerned with the academic world only. In the 1957-1966 cohort, the increments range from 28.3 percent for the behavioral scientists (who, on the average, are older within a given Ph.D. cohort) to 31 percent for the life scientists and 36.5 percent for the EMP fields, which encompass the youngest members of a given cohort. The differences here may therefore be age-related. No consistent variations are shown for the other cohorts, but it is worthy of note that the increments, with a single exception, are lower than those for the corresponding fields and cohorts in column 1, which is based on all work activities and thus provides a kind of normative frame.

---

[4]National Research Council, Careers of Ph.D.'s: Academic versus Nonacademic, (Washington, D.C.: National Academy of Sciences, 1968).

TABLE 15 Salary Percentage Increments[1] of Full-time Employed Male Doctoral Scientists and Engineers by Field Group, Ph.D. Cohort, Employer Category, and Primary Work Activity Pattern, 1973-1977

Employer Category by Field Group and Ph.D. Cohort, 1973-1977	Total All Patterns	Primary Work Activity Constant				Pattern of Switching		
		Teaching	Research	Admin.	Other	Teaching to Admin.	Research to Admin.	All Others
1957-1966 Ph.D.'s								
Academe, 1973-1977								
EMP Fields	37.0	36.5	57.9	30.0	37.2*	39.6	41.6	32.6
Life Sciences	35.6	31.0	43.8	32.3	33.2	38.8	48.3	32.6
Behavioral Sciences	30.4	28.3	37.0	29.5	23.8*	42.9	58.6	29.2
Business/Industry, 1973-1977								
EMP Fields	40.8	–	38.1	44.2	37.5	–	46.4	38.9
Life Sciences	44.7	–	37.8	59.9	31.8	–	42.8	30.9
Behavioral Sciences	31.5	–	34.3*	40.6	23.7	–	(87.3)	30.2
U.S. Government, 1973-1977								
EMP Fields	33.5	–	34.6	31.4	32.9*	–	39.1	32.0
Life Sciences	34.4	–	33.5*	34.9	29.6	–	38.2	35.0
Behavioral Sciences	29.9	–	29.8*	32.7	28.4*	–	(20.1)	27.0
1967-1969 Ph.D.'s								
Academe, 1973-1977								
EMP Fields	36.6	35.3	40.4	36.6	(44.9)	41.7	3[illegible].2*	37.2
Life Sciences	41.1	33.7	49.2	40.2	40.6*	52.0	[illegible]3.1	41.1
Behavioral Sciences	35.0	33.7	37.7	45.8	32.1*	49.4	51.7*	31.0
Business/Industry, 1973-1977								
EMP Fields	44.3	–	42.1	51.7	41.6	–	49.6	41.3
Life Sciences	82.7	–	48.2	54.6	372.3*	–	50.0*	55.4
Behavioral Sciences	44.9	–	44.7*	45.5*	39.9	–		58.0*
U.S. Government, 1973-1977								
EMP Fields	39.9	–	37.3	41.8	49.9*	–	43.4	41.0
Life Sciences	37.3	–	36.4	45.0*	(38.9)	–	40.4*	33.9
Behavioral Sciences	35.3	–	36.1*	32.5*	(31.8)	–		41.3*
1970-1972 Ph.D.'s								
Academe, 1973-1977								
EMP Fields	40.7	35.1	55.5	37.3	36.3*	50.3	61.9*	43.3
Life Sciences	45.2	38.0	52.3	32.7*	49.7	54.9	53.5*	49.6
Behavioral Sciences	46.0	48.4	37.4	31.0	29.6*	46.1	53.4*	42.1
Business/Industry, 1973-1977								
EMP Fields	53.4	–	43.5	57.9	49.2	–	56.6	60.0
Life Sciences	78.8	–	47.8*	58.6*	79.9	–	70.3	98.9
Behavioral Sciences	46.7	–	(79.4)	(26.0)	52.7*	–		42.5
U.S. Government, 1973-1977								
EMP Fields	45.7	–	42.1	48.5	63.8*	–	43.7	44.0
Life Sciences	47.2	–	42.6	53.6		–	53.1	55.3*
Behavioral Sciences	52.4	–	49.8*	63.5*	(46.5)	–		45.9*

[1] Increments based on fewer than 60 sample individuals are marked with an asterisk; those based on n's <20 are shown in parentheses.

Research, shown in column 3, tends to yield the highest salary increments in the academic world, the only exception being a datum based on very few cases. In the business world, and in governmental service, however, research plays second fiddle to administration in winning salary increments--again with few exceptions. Administrators, in academe, in the 1957-1966 cohort, fare about

the same as teachers--i.e., rather poorly in increments, but of course from a higher initial status. In the middle cohort, academic administrators make quite satisfactory gains; in the youngest cohort, as in the oldest, they tend to do rather poorly with respect to salary increments. Perhaps the nature of the administrative duties and responsibilities is quite different for these younger men than for those in the next older cohort; there is no way to tell from the available data.

The column for all other types of primary work activity relates (by definition) to a rather undefined set of functions, and contains relatively few cases; it is presented for the sake of completeness and will not be further discussed.

Switching PWA Yields Higher Increments

Changing work activities are shown in the last three columns. The first of these relates to the academic world only, as it shows salary increments for those who shifted from teaching to administration. In all cases, the groups that made this transition experienced greater average increments than did those who remained in either teaching or administration.

Switching from research to administration, shown in the next-to-last column, usually results in greater salary increments than does staying in research, or even staying in administration, in most instances, although there are exceptions. As administrators tend to earn higher salaries, the incremental advantage may well mean simply tending to catch up with those who were already in administration in 1973. The final column (all other work activity switches) is too heterogeneous to permit meaningful comment; it is presented simply to complete the table.

An Index of Relative Salary Levels

Up to this point we have dealt with salary levels and salary increments. The data on salary differentials related to employer category or primary work activity are somewhat difficult to deal with in terms of the mean salary levels directly; it is convenient to translate them into relative terms to get a better picture of the ways and degrees by which they are differentiated. To do this, the raw salary data were transformed into relative salaries, based on

a generalized group as a norm with a salary of 100. For example, in Table 16, the mean salary for all employer categories (holding constant field, sex, and cohort) is taken as 100; the entries under each employer category thus show as percentages of this generalized base. Table 16 shows these data for both 1973 and 1977, for men only. They also include only the full-time employed men for whom data were available in both years. Within each field and cohort, the norm is for all employer categories combined. This norm obviously varies by field and cohort; the normalization permits comparisons across these groups.

TABLE 16 1973 and 1977 Relative Salaries* of Full-time Employed Male Doctoral Scientists and Engineers by Employer Category, Field Group, and Ph.D. Cohort

Field of Doctorate by Ph.D. Cohort	Employer Category, 1973-1977							
	Academe		Business/Industry		U.S. Government		All Other	
	1973	1977	1973	1977	1973	1977	1973	1977
1957-1966 Ph.D.'s								
Total, All Fields	93.0	91.6	113.3	117.6	111.3	110.3	99.7	97.8
EMP Fields	91.6	89.2	110.2	114.0	113.4	110.9	91.0	90.9
Life Sciences	94.7	94.4	116.2	119.1	108.0	108.2	106.1	101.7
Behavioral Sciences	94.4	94.5	139.4	138.2	121.0	121.0	103.0	102.9
1967-1969 Ph.D.'s								
Total, All Fields	91.9	89.7	114.5	119.7	113.6	112.3	98.0	99.3
EMP Fields	90.1	87.2	110.9	114.5	111.0	110.1	91.5	94.0
Life Sciences	95.1	93.2	116.0	128.6	115.5	112.2	94.8	102.5
Behavioral Sciences	93.8	93.2	139.4	146.9	130.8	129.7	107.9	105.9
1970-1972 Ph.D.'s								
Total, All Fields	91.9	89.7	114.0	120.1	112.3	114.6	106.5	108.5
EMP Fields	88.1	85.1	111.0	115.9	111.0	111.3	103.0	105.2
Life Sciences	95.8	94.3	106.6	115.9	114.4	116.2	102.0	107.2
Behavioral Sciences	94.7	93.7	144.6	149.7	120.2	130.1	112.2	113.9

*Relative salary for total of all constant employer categories, 1973-1977, within field and cohort of doctorate for each survey year equals 100.

Reliability of Salary Index Figures

There is a remarkable degree of consistency of the pattern of salary differentials by employer category, both in 1973 and 1977, as shown in Table 16. In the academic world, where the numbers are large enough to provide very stable means, the 4-year difference is never over 3 index points, and with a single exception in which it increases by 0.1 point, the indices are lower in 1977 than in 1973. The average drop is almost 2 index points. This means that relative to the salaries in all employer categories, the academicians lost

almost two percentage points over the four year interval. Those in the EMP fields suffered the greatest relative losses; the behavioral scientists the least.

The business/industry sector has the highest salary indices, and the differentials as compared to the grand mean increased by an average of over 5 points. The single exception was again in the behavioral sciences field, where the favorable differential, in the oldest cohort, dropped from 39.4 percent to 38.2 percent.

In the U.S. government sector, the differentials were also favorable, by an average of a little more than 12 points over the grand mean. They changed little from 1973 to 1977, except in groups where the numbers were so small as to make for unreliable statistics (behavioral sciences). In the miscellaneous "all other employer" category, the year-to-year changes in the indices were again generally small, maintaining the same pattern from 1973 to 1977. That pattern shows unfavorable differentials for the older physical scientists and engineers, but favorable differentials for the behavioral scientists, especially the younger ones.

Salaries Relative to Employer Category

The salary differentials (for 1973 salaries, which have the more conservative patterns) are shown graphically in Figure 11. These data are from Table 16. What is outstanding in Figure 11 is the regularity, across fields and cohorts, of the pattern of employer category differences. The academic world is generally lowest, with the "other employers" not much better, while the business/industry group is highest, with government not far behind. Although these patterns are similar, the amount of variation among the employer categories is not the same in all field groups. The behavioral sciences show the greatest variation: in this field group men employed in business and industry earn, on the average, about 40 percent more than the mean of all categories combined. In the behavioral sciences, the government mean salaries, and those in the "other" categories are also considerably higher, relative to the academic salaries, than they are in the natural science fields. The range of variation shown here is in part a function of the relative concentration; in the behavioral sciences almost 80 percent of the men are academicians, while in the EMP fields

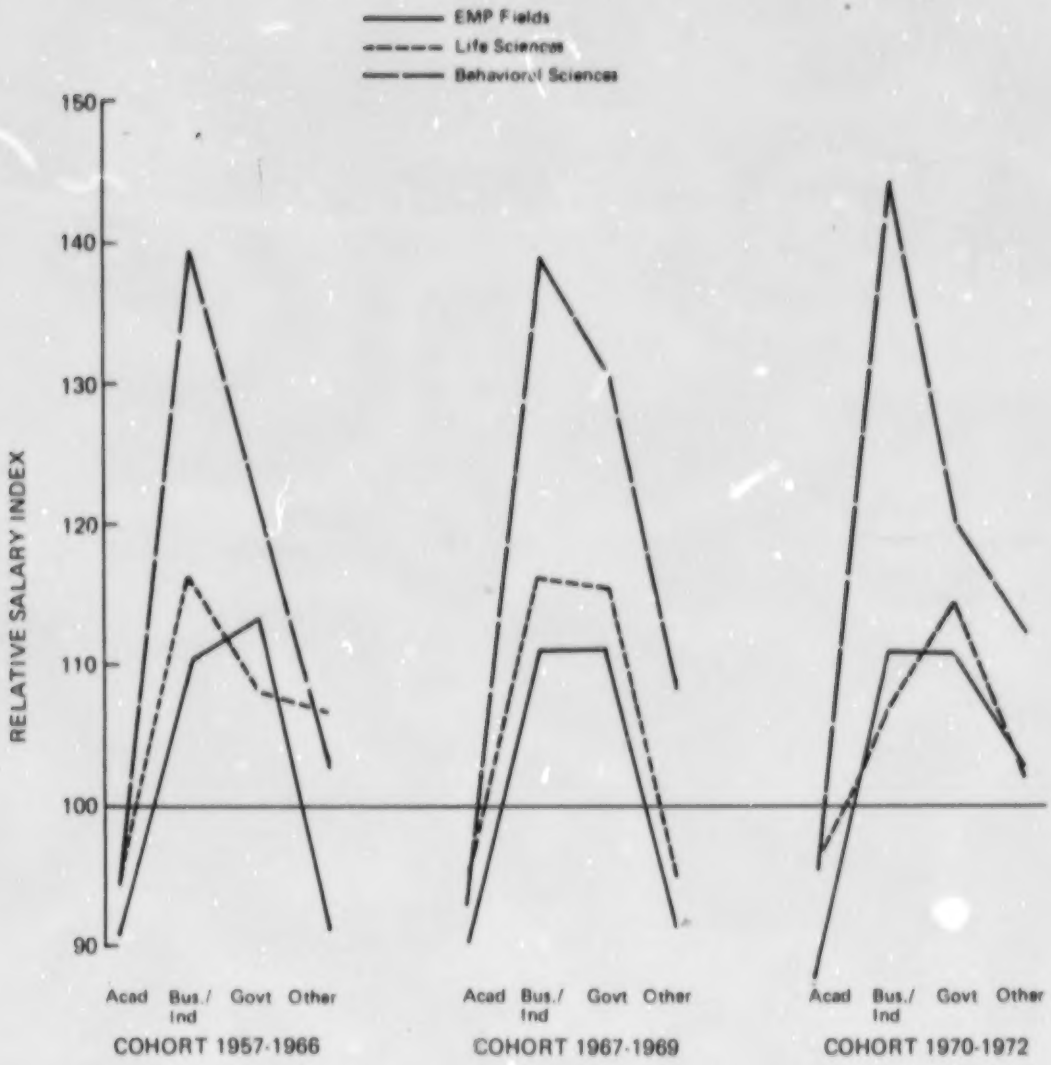


FIGURE 11 Relative Salaries* of Full-time Employed Male Doctoral Scientists and Engineers by Employer Category, Cohort and Field of Doctorate, 1973

*Average salary of all employer categories within each field by cohort equals 100.

this proportion is about half, and in the life sciences about 2/3. In the EMP fields, the business/industry sector employs almost 40 percent of the men; it would be manifestly impossible for this mean to greatly exceed the grand mean of which it is a part. In the behavioral sciences, on the other hand, only from 4 percent to 7 percent are employed in business and industry.

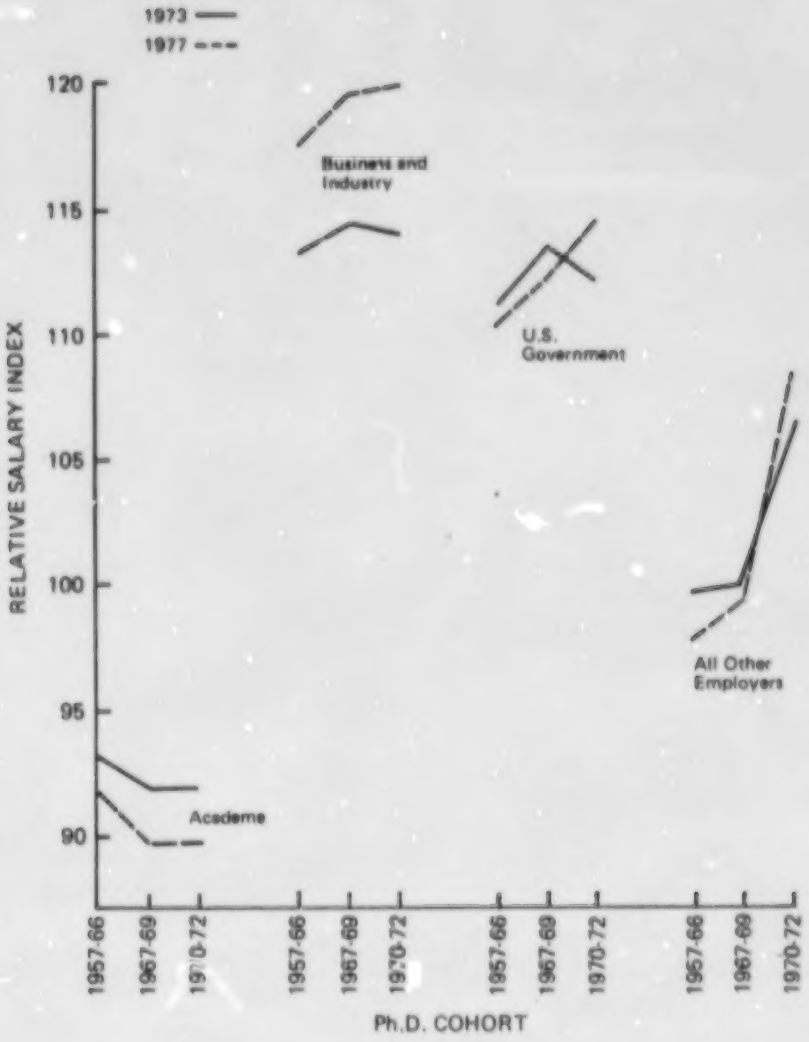


FIGURE 12 1973 and 1977 Relative Salary Patterns of Full-time Employed Male Doctoral Scientists and Engineers by Employer Category and Ph.D. Cohort

Another way of looking at the salary differentials for employer categories is shown in Figure 12, also derived from Table 16. Here both the 1973 and 1977 salaries are shown, in terms of index numbers, but for all fields combined. In each employer category, the three Ph.D. cohorts are shown, with relative salaries, 1973 and 1977 given separately. Again, the resemblance of the patterns is striking; the 1973 patterns are replicated in 1977 with remarkable fidelity.

considering the small numbers of cases in some instances. Particularly noteworthy, however, is the fact that the inter-employer patterns are accentuated in 1977. That is, the differentials across employer categories have become greater. The relative position of academic salaries is lower, that of business and industry greater. For the other groups, the results are somewhat mixed: the older cohorts have lower relative salaries in 1977, while the youngest cohort (the Ph.D.'s of 1970-1972) have higher relative salaries in the governmental and "other employer" categories.

Relative Variability

A measure of relative variability, in which the standard deviation is divided by the mean (called the coefficient of variation, or C.V.) is informative in connection with employer category differentials. The C.V.'s, by field, cohort, and employer category, for male science and engineering Ph.D.'s in 1973 and 1977, are shown in Table 17.

TABLE 17 Coefficients of Variation* of Salaries of Full-time Employed Male Doctoral Scientists and Engineers by Ph.D. Cohort, Field, and Employer Category, 1973 and 1977

Ph.D. Field and Survey Year	1957-1966 Ph.D.'s				1967-1969 Ph.D.'s				1970-1972 Ph.D.'s			
	Acad.	Bus.	Govt.	Other	Acad.	Bus.	Govt.	Other	Acad.	Bus.	Govt.	Other
TOTAL, ALL FIELDS												
1973	23	34	19	39	22	20	18	28	24	24	20	34
1977	24	37	18	36	23	28	16	30	22	26	17	32
EMP Fields												
1973	23	31	18	28	22	17	17	23	24	23	20	27
1977	22	36	16	30	21	25	16	28	22	24	16	34
Life Sciences												
1973	25	36	16	33	24	37	16	34	26	21	21	34
1977	28	36	15	28	26	35	13	45	26	22	17	3[illegible]
Behavioral Sciences												
1973	21	43	18	46	19	25	20	20	23	24	16	26
1977	24	44	21	43	22	37	15	20	21	27	15	25
Average of 3 Fields, by Cohort												
1973	23	37	17	36	22	23	18	26	24	23	19	36
1977	25	39	17	34	23	32	15	31	23	24	16	33
Average of 3 Cohorts, Combining Fields												
1973					23	28	18	33				
1977					24	32	16	33				

*Coefficient of variation equals 100 times the standard deviation divided by the mean.

An interesting aspect of the C.V.'s in Table 17 is that the relative variability of salaries in business and industry is far greater than that in

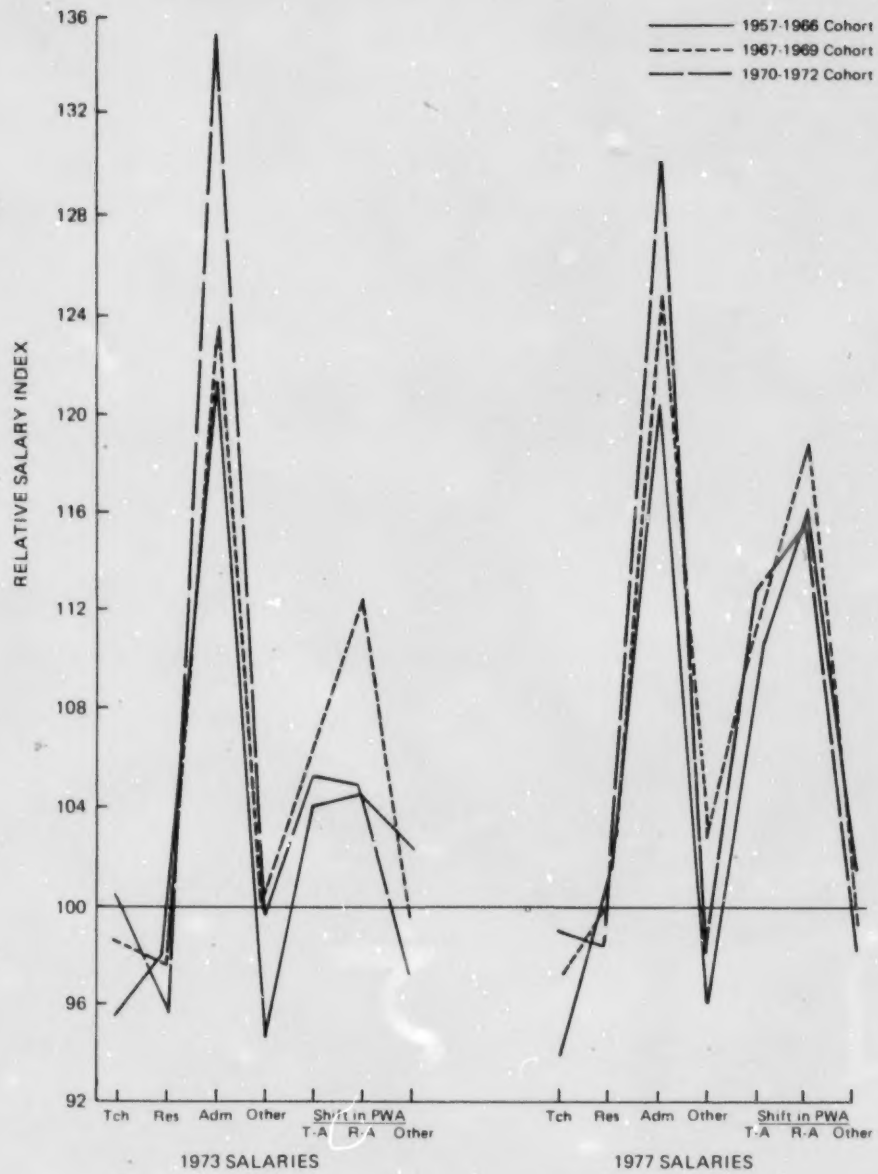


FIGURE 13 1973 and 1977 Relative Salaries* of Full-time Employed Male Doctoral Scientists and Engineers in Academe by Ph.D. Cohort and Primary Work Activity Pattern

*Average salary of all primary work activities within field by cohort equals 100.

academe, while the relative variability of salaries in government is far less. This difference is apparent in 1973, and increases in 1977. The reason, of course, is that some science and engineering Ph.D.'s move into high management positions in business/industry, where salaries far exceed those available in the academic world. At the same time, top government salaries were frozen for many years, while salaries at the lower grades moved upwards. This phenomenon suggests that financial incentives may account in part for the relatively greater movement from governmental to industrial and academic positions noted in Figure 4, Chapter 1.

Salaries Relative to Primary Work Activity Pattern

Another variable that affects salary levels profoundly is primary work activity. The PWA variations, holding constant employer category, cohort, field, and sex, are shown in Tables 18 and 19. Variations in men's salaries in the academic world, by cohort and PWA, but combining all fields, are shown graphically in Figure 13. In Figure 13, the outstanding pecuniary advantage of administrative jobs comes through in both 1973 and 1977 salaries, for all three cohorts, as does the financial advantage of switching from teaching or research to administrative work. There are differences by cohort and differences between 1973 and 1977, but the patterns are highly similar. Fields differ, too, as can be seen in Table 18, but the pattern is still the same with regard to the leading position of administrative work, from the standpoint of salary. The data in both of these tables and in both graphs are for men only. The sex difference, because the proportion of men is higher in administrative work than in other functions, is even greater than would be shown in the tables, which are here omitted because of the rather small numbers of women in many of the cells when the data are sectioned by field, cohort, primary work activity, and employer category. In both of the tables given here, the relatively unreliable data caused by small numbers are marked: data based on fewer than 60 individuals are marked with an asterisk; where the original n is less than 20, the data are placed in parentheses. As can be seen, even in the case of men, this occurs rather frequently. The general pattern is nevertheless evident; the less reliable figures simply vary farther above and below the values found for those based on larger numbers of cases.

TABLE 18 1973 and 1977 Relative Salaries[1] of Full-time Employed Male Doctoral Scientists and Engineers in Academe by Primary Work Activity Pattern (PWA) and Ph.D. Field Group

Field Group and Cohort of Ph.D.	1973 Relative Salaries by PWA Pattern							1977 Relative Salaries by PWA Pattern						
	Tch.	Res.	Adm.	Other	T-A[2]	R-A[2]	Other Sw[2]	Tch.	Res.	Adm.	Other	T-A[2]	R-A[2]	Other Sw[2]
1957-1966 Ph.D.'s														
Total, All Fields	95.3	98.1	122.4	94.4	104.0	104.5	102.2	93.8	101.7	120.5	96.0	109.6	115.9	101.4
EMP Fields	95.6	100.1	125.4	98.1*	103.0	107.0	101.3	94.6	104.6	123.2	100.6*	107.6	113.5	100.8
Life Sciences	94.7	97.4	122.6	97.4	105.5	104.1	102.0	92.6	99.7	120.5	98.3	113.2	114.5	101.2
Behavioral Sciences	94.1	108.2	116.7	88.3*	102.4	107.5	103.6	92.5	113.7	115.7	87.3*	109.0	127.6	102.5
1967-1969 Ph.D.'s														
Total, All Fields	98.5	97.5	123.8	100.2	105.5	112.6	99.6	97.1	100.0	124.7	102.7	111.9	118.7	98.8
EMP Fields	98.7	97.7	127.6	(110.8)	107.5	119.7*	97.4	98.2	100.0	124.4	(118.2)	110.7	122.7*	96.9
Life Sciences	96.6	97.2	125.7	101.4*	109.5	115.4	101.4	93.1	99.5	125.7	103.7*	118.1	119.1	101.8
Behavioral Sciences	98.2	104.4	115.1	94.5*	98.6	101.4*	100.9	97.3	104.8	124.0	92.9*	108.4	114.8*	98.4
1970-1972 Ph.D.'s														
Total, All Fields	100.6	94.8	135.5	99.3	105.2	105.0	97.1	98.9	98.2	130.2	97.6	112.6	115.6	98.1
EMP Fields	102.2	91.8	130.5	88.1*	102.0	119.6	95.6	99.8	99.3	130.4	84.0*	109.9	129.7	95.7
Life Sciences	99.8	98.4	138.2*	103.0	105.0	95.6*	98.7	97.7	98.4	127.5*	104.9	115.3	104.8*	100.7
Behavioral Sciences	98.8	104.8	138.0	102.7	105.0	93.6*	97.3	98.2	100.1	130.8	97.5*	110.8	104.8*	98.3

[1] The mean of all PWA patterns within field and cohort equals 100. Where relative salaries are based on fewer than 20 individuals, the data are enclosed in parentheses; where based on 20 to 59 individuals, they are marked with an asterisk.
[2] Switches in primary work activity, 1973-1977, are denoted as follows: T-A = teaching to administration; R-A = research to administration; the final column for each salary year is for all other switches of PWA.

Patterns in Nonacademic Employment

Examination of the patterns in Table 19 reveals some interesting differences between employer categories in the relative rewards to differing primary work activities. For example, in the business/industry sector, the relative advantage of administrative work increases from 1973 to 1977, while in the governmental sector this is true only for the younger cohorts. For the older government workers, the relative advantage decreases -- undoubtedly a consequence of the ceiling that prevailed for several years on top administrative salaries in the Federal government. In the miscellaneous "other employer categories" there is no marked change from 1973 to 1977 in the administrative advantage in salary level. In both industry and government, those who switch from research to administration between 1973 and 1977 generally (but not always) were earning more in research in 1973 than were those who remained in research, and increased their salary advantage further by switching, as shown by the 1977 salary data. This does not hold in the "other employer" category, where the data are rather spotty in any case because of the small numbers of cases.

Additional Analyses

If time and funds permitted, further examination of salary patterns would no doubt provide additional useful information. Other statistical measures and methods could be employed, for example, to deal with the more

TABLE 19 1973 and 1977 Relative Salaries[1] of Full-time Employed Male Doctoral Scientists and Engineers in Non-academic Employment by Primary Work Activity Pattern (PWA), Employer Category, Field and Cohort of Doctorate

Field Group and Cohort of Doctorate	1973 Relative Salary by PWA Pattern					1977 Relative Salary by PWA Pattern				
	Research	Admin	Other	R-A[2]	Other Sw[2]	Research	Admin	Other	R-A[2]	Other Sw[2]
Business/Industry Employment										
1957-1966 Ph.D.'s										
Total, All Fields	88.9	112.7	99.0	89.1	97.5	88.4	116.0	95.0	93.7	94.9
EMP Fields	89.3	114.1	97.8	91.2	96.5	88.2	116.4	96.4	95.2	94.3
Life Sciences	91.0	109.8	87.1	87.1	99.7	91.3	115.6	79.4	90.8	93.0
Behavioral Sciences	94.4*	119.5	94.2	(75.5)	99.4	98.3*	124.8	87.6	(97.7)	101.3
1967-1969 Ph.D.'s										
Total, All Fields	95.3	110.5	101.7	97.8	97.0	93.2	115.8	99.7	100.5	95.5
EMP Fields	96.3	111.5	98.8	97.8	97.6	94.5	117.5	96.8	101.0	95.5
Life Sciences	94.8	107.6	79.2*	106.7	98.7	90.1	107.3	94.9*	104.1	98.4
Behavioral Sciences	82.8*	112.9*	106.1		89.5*	84.9*	117.2*	101.7		96.5*
1970-1972 Ph.D.'s										
Total, All Fields	97.0	112.3	100.1	96.5	99.9	93.8	116.5	99.3	101.6	99.5
EMP Fields	97.3	111.1	100.3	98.1	99.5	93.8	116.9	99.4	102.8	99.4
Life Sciences	105.6*	113.1*	89.1	99.6	100.4	100.8*	116.0*	90.0	107.1	97.7
Behavioral Sciences	(74.3)	(130.4)	105.3*		98.0	(92.1)	(114.2)	105.0*		98.4
U.S. Government Employment										
1957-1966 Ph.D.'s										
Total, All Fields	90.5	113.3	105.2	95.5	102.7	91.1	112.3	102.7	98.7	101.7
EMP Fields	91.2	113.1	93.3*	95.4	97.6	92.6	110.6	93.1	99.7	96.9
Life Sciences	94.8	113.9		99.1	103.6	94.0	114.9		101.8	104.3
Behavioral Sciences	86.3	101.6	105.7*	(94.4)	107.2	87.2	103.6	102.8*	(86.7)	104.3
1967-1969 Ph.D.'s										
Total, All Fields	96.2	116.8	96.8*	101.4	97.4	95.6	118.9	93.7	103.6	95.9
EMP Fields	98.3	114.9	(75.0)	100.7	94.0	96.7	117.0	75.9*	104.5	94.0
Life Sciences	96.8	110.4*	(98.6)	108.4*	102.5	97.1	116.6*	(100.3)	108.4*	96.7
Behavioral Sciences	91.9*	119.4*	(105.1)		93.4*	92.9	117.8*	(103.6)		95.6*
1970-1972 Ph.D.'s										
Total, All Fields	96.8	108.4	90.7	101.4	101.1	95.0	112.3	91.6	103.8	100.1
EMP Fields	95.1	112.2	85.9	101.0	100.9	94.2	115.7	93.0	101.9	98.9
Life Sciences	99.8	101.6	(110.8)	103.6	88.7*	97.6	103.6	(91.4)	109.0	96.1*
Behavioral Sciences	102.7*	100.2*	(80.5)		109.0*	98.3*	107.2*	(78.6)		104.1*
Other Nonacademic Employment										
1957-1966 Ph.D.'s										
Total, All Fields	93.5	115.7	92.8	92.9	92.7	94.8	115.5	94.2	90.5	91.6
EMP Fields	94.8	116.8	85.4	92.0	96.6	94.5	117.4	83.4*	94.3	95.6
Life Sciences	93.2	113.5	(135.9)	(89.3)	91.5	95.4	109.2	(142.4)	(83.0)	93.2
Behavioral Sciences	107.4	114.2	46.4	101.5*	89.8	108.9	116.3	89.0	91.8*	87.3
1967-1969 Ph.D.'s										
Total, All Fields	93.1	105.9	107.2	109.1	98.6	96.9	107.7	99.1	106.6	100.5
EMP Fields	97.4	109.8*	98.9*	113.0*	99.4	99.1	111.5*	88.9*	109.3*	102.9
Life Sciences	93.7	101.2*	(122.7)		101.5	91.5	91.9*	129.2*		106.8
Behavioral Sciences	100.3*	108.1*	99.7	(102.0)	96.9	111.1*	119.3*	93.9	(102.1)	94.0
1970-1972 Ph.D.'s										
Total, All Fields	92.4	110.0	97.7	103.9	101.5	94.9	110.9	96.7	103.1	100.9
EMP Fields	100.1	114.1*	114.3*	111.4*	92.3	96.5	106.3*	104.5*	106.0*	103.2
Life Sciences	92.1	112.3*	103.3	97.1*	106.0	99.3	110.0*	107.1	95.1*	89.6*
Behavioral Sciences	90.2*	106.1	88.5	(113.1)	103.1	91.4*	110.2	88.9	(115.7)	100.8

[1] The mean of all PWA patterns within field and cohort equals 100. Where relative salaries are based on fewer than 20 individuals, the data are enclosed in parentheses; where based on 20 to 59 individuals, they are marked with an asterisk.

[2] Switches in primary work activity, 1973-1977, are denoted as follows: R-A = research to administration; Other Sw = all other switches of PWA.

sparse and unreliable data. Analysis of variance and covariance might well produce useful information regarding women's salaries and sex differences, or usefully describe the combined effects of employer category and primary work activity.

The relationship of the variables dealt with in this report to other

variables available in the work tape used to produce these tabs should provide additional valuable information. The other data available include institutions (and categories of institutions) of baccalaureate and doctorate origin and of current employment, age at doctorate, and educational level of parents. It is highly probable that these variables relate significantly to career patterns, but the nature, direction, and extent of these relationships remain to be explored.

APPENDIX A

Percentage Time Distribution and Primary Work Activity

Chapter 2 provided a brief introduction to the relationship of Primary Work Activity to percentage distribution of time among a number of functions summarized into the same four general categories: Teaching, Research, Administration, and "Other". The subject is developed in more detail in the tables and graph that follows. These tables are based on a set of categories or ranges of percentage of time devoted to each activity that would simplify analysis somewhat and still not lose essential detail. For this purpose, there were constructed four ranges of time devoted to each activity: (1) Exclusive, i.e., 100% time in a single activity; (2) High: 70 percent to 99 percent time devoted to the activity; (3) Medium: 40-69 percent; and (4) Low: Less than 40 percent time to the given activity. In tables that follow, these ranges are designated respectively: X, H, M, and L. From the numbers given above, it is apparent that if one activity is H, no other can be more than L (100%-70%=30% maximum). However, it is possible to have one, two or three other activities combined with the primary activity, as long as they do not sum to more than 30 percent. Similarly, there may be two M activities, e.g., a 50/50 split, or a 40/60 split. Or M could be combined with as many as three L activities. In theory, there could be patterns of three L activities, or even four L activities. However, the tabulations showed these to be so rare that, combined, they did not account for even one percent of the patterns. A total of 91 different patterns were found, some of them extremely infrequent. Table A.1 shows the proportion of cases, by PWA and work environment, who were in the Exclusive, High, Medium, and Low range, together with the numbers of cases. Table A.2 provides more detail, showing the principal patterns found. "Principal pattern" here means a pattern that characterized one percent or more of the cases. The data of Table A.1 are shown graphically in Figure A.1.

On the left side of Table A.1 the data are given for those respondents who worked in the academic world, sub-divided by PWA. On the right half of the table are data for those in the nonacademic world, similarly subdivided. Taking the first column as an example, the table shows that of the respondents who

indicated teaching as a primary work activity, only 10.5 percent were doing teaching exclusively. Another 38 percent indicated a high proportion of their time (70-99 percent) devoted to teaching, while 43.5 percent indicated a medium amount of time (40-69 percent) of their time in teaching. Only 8 percent of the respondents indicated a low proportion (less than 40 percent) of their time in teaching--of those who gave teaching as the primary work activity. Each column should be read in the same way, for both the academic and nonacademic groups. It is noteworthy that very few (sample n = 93, weighted N = 444) of the nonacademic group indicated teaching as a primary work activity. Nonacademic includes secondary schools, as well as nonprofit organizations, hospitals, and the self-employed. Some in these categories, as well as in business and industry, and in government, might well be expected to be teachers primarily. The table shows that this group numbers fewer than one percent of the nonacademic employers however.

TABLE A.1 Time Distribution Percentages as a Function of Primary Work Activity (PWA) by Academic or Nonacademic Employment for 1934-1972 Full-time Employed Doctoral Scientists and Engineers, 1977

	PWA in Academic Environment				PWA in Nonacademic Environment			
Percent Time in PWA	Teaching	Research	Admin.	Other	Teaching	Research	Admin.	Other
Total Number	36,560	14,847	9,696	3,116	444	15,143	19,311	12,483
Exclusive (100%)	10.5	12.1	15.7	20.4	25.0	29.8	39.1	42.0
High (70-99%)	38.0	31.3	30.4	27.8	19.1	37.5	28.4	36.9
Medium (40-69%)	43.5	37.0	44.4	43.4	41.8	26.4	25.6	15.7
Low (1-39%)	8.0	19.6	9.5	8.4	14.1	6.3	6.9	5.4
Percent in Each PWA	56.9	23.1	15.1	4.9	0.9	32.0	40.8	26.3

The data of Table A.1 are shown graphically in Figure A.1, in terms of vertical bars dividing the time distribution into the four ranges, Exclusive (at the top), High, Medium, and Low (portion at the bottom). Exclusive devotion to a single activity is far more common in the nonacademic world than in academe. The academic/nonacademic distinction was found to produce the greatest variation in patterns of time distribution, but there were also differences by sex and by cohort, as shown in Table A.2.

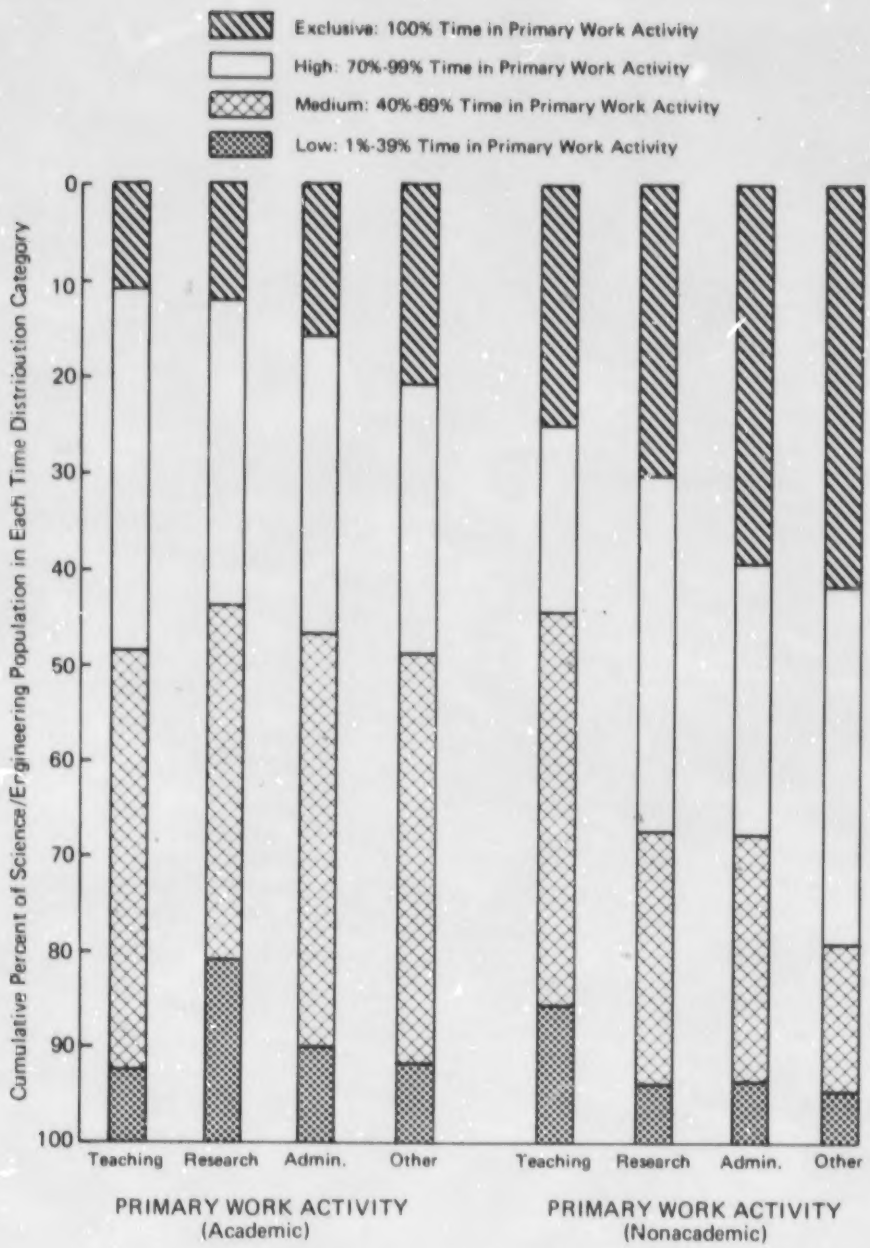


FIGURE A.1 Time Distribution as a Function of Primary Work Activity for 1934-1972 Full-time Employed Doctoral Scientists and Engineers, 1977

In Table A.2, there are four sub-tables, one for each of the Primary Work Activities. At the left, the time distribution patterns are indicated, under the heading TRAO for Teaching, Research, Administration, and Other. The first four columns give the data by cohort, combining all work environments, all fields, and both sexes. The next four columns give data according to work environment and sex, combining all cohorts and fields. An explanation of the system of symbols used to designate the time distribution patterns will facilitate reading the tables.

The first pattern in Table A.2 is that for an X under T, thus indicating exclusive devotion to teaching. The next three patterns indicate combinations of high teaching, and low in each of the other activities: HL--means high in teaching, low in research, and nothing under administration or other. H-L- means high in teaching and low in administration, nothing under research or other. H--L means no research or administration, and high in teaching, low in "other".

The next set of three patterns indicates H in teaching, and L in each of two other activities: HLL- means high teaching, low research and administration, no other; H-LL means high teaching, no research, low administration and other. HL-L means high teaching, no administration, low research and other.

The line HLLL means that in addition to high in teaching, the respondent had a low amount of time in each of the other three activities. Below this line is a summation of all the H (High in teaching) patterns. These summary percentages will not be exactly comparable to those in Table A.1 because in Table A.2 only the principal patterns are counted--those which were given by more than one percent of the respondents.

The remainder of the table is to be read in the same fashion. It is noteworthy that there is a blank under Nonacademic for patterns involving teaching as a high or medium activity. The cases in the nonacademic world who engage heavily in teaching are too sparse to come within the definition of "principal patterns".

Close examination of Table A.2 will show that even when academic/nonacademic environment and primary work activity are controlled, there are some sex differences in patterns of time distribution. The sex differences fall into a familiar pattern: women do more teaching and less administration than men, even when PWA and environment are controlled.

TABLE A.2 Principal Patterns of Time Distribution within Primary Work Activity Groups, by Ph.D. Cohort, and by Sex within Academic and Nonacademic Environments for 1934-1972 Full-time Employed Doctoral Scientists and Engineers, 1977

Time Distribution Pattern (TRAO)[1]	All Environments, Sexes Combined				Cohorts Combined, by Environment			
					Academic		Nonacademic	
	1934-66	1967-69	1970-72	1934-1972	Men	Women	Men	Women
Percent in Each Pattern, with TEACHING as PRIMARY WORK ACTIVITY								
X- - -	9.9	11.5	12.0	10.7	10.2	14.6	–	–
HL- -	13.9	16.0	15.6	14.7	15.2	11.2	–	–
H-L-	4.6	3.5	3.8	4.2	4.1	5.8	–	–
H- -L	6.8	6.9	8.1	7.1	6.8	10.8	–	–
HLL-	2.2	3.0	2.1	2.3	2.4	1.2	–	–
H-LL	1.5	1.2	1.9	1.6	1.5	2.4	–	–
HL-L	6.0	7.1	8.2	6.7	6.6	9.4	–	–
HLLL	1.3	0.9	1.5	1.2	1.3	0.8	–	–
Total H	46.2	50.1	53.2	48.5	47.1	56.2	–	–
MM- -	8.2	9.1	7.2	8.2	8.5	4.6	–	–
M-M-	2.6	1.4	1.5	2.1	2.1	2.3	–	–
M- -M	2.1	2.4	2.3	2.2	2.0	3.1	–	–
MML-	1.9	1.8	1.2	1.7	1.8	0.3	–	–
MM-L	2.4	2.4	2.9	2.5	2.6	1.5	–	–
MLL-	5.5	4.8	3.6	5.0	5.1	2.6	–	–
ML-L	7.6	7.4	9.1	7.9	8.0	8.0	–	–
M-LL	2.3	2.3	2.4	2.3	2.1	2.7	–	–
MLLL	7.7	6.6	6.1	7.1	7.3	6.0	–	–
Total M	40.3	38.2	36.3	39.0	39.5	31.1	–	–
LLLL	1.8	1.7	1.2	1.6	1.7	1.1	–	–
Percent in Each Pattern, with RESEARCH as PRIMARY WORK ACTIVITY								
-X- -	21.2	21.2	20.3	21.0	11.8	16.3	29.8	28.7
LH- -	7.2	7.7	7.0	7.2	13.4	13.6	1.1	3.1
-HL-	8.8	8.3	7.1	8.3	3.1	1.8	13.5	12.3
-H-L	9.1	9.6	12.0	9.9	4.6	9.2	14.6	18.5
LHL-	1.3	1.4	1.4	1.3	2.0	3.3	0.6	0.9
LH-L	2.7	2.4	3.0	2.7	4.1	7.6	1.0	3.9
-HLL	3.7	4.0	5.4	4.2	2.3	1.2	6.0	7.3
LHLL	0.7	0.9	0.8	0.8	1.3	1.7	0.2	0.9
Total H	54.7	55.5	57.0	55.4	44.6	54.7	66.8	75.6
MM- -	5.1	6.9	5.9	5.7	11.5	9.2	0.1	0.0
-MM-	3.0	1.8	1.5	2.4	1.5	0.0	3.4	1.1
-M-M	5.2	5.8	5.9	5.5	2.5	2.2	8.5	6.7
MML-	1.5	1.1	1.3	1.4	2.9	1.2	0.0	0.2
MM-L	1.4	1.3	2.1	1.5	3.1	3.2	0.0	0.0
-MLM	1.1	1.0	0.9	1.0	0.3	0.0	1.9	1.1
-MML	0.5	0.9	1.1	0.7	0.2	0.1	1.2	0.5
LML-	3.3	2.1	1.4	2.6	4.8	3.1	0.6	0.2
LM-L	4.1	3.8	2.9	3.7	7.1	6.6	0.4	1.1
-MLL	4.7	5.4	6.0	5.2	2.4	1.4	8.0	6.1
LMLL	5.9	5.3	4.8	5.5	9.8	6.1	1.6	1.4
Total M	35.8	35.3	33.8	35.2	47.1	35.3	26.7	18.4
LLLL	1.1	1.6	1.3	1.2	2.4	2.1	0.1	0.3

TABLE A.2 (Continued)

Time Distribution Pattern (TRAO)[1]	All Environments, Sexes Combined				Cohorts Combined, by Environment			
					Academic		Nonacademic	
	1934-66	1967-69	1970-72	1934-1972	Men	Women	Men	Women
Percent in Each Pattern, with ADMINISTRATION as PRIMARY WORK ACTIVITY								
- -X-	35.2	23.0	22.2	31.2	15.7	15.5	39.6	21.2
L-H-	5.1	4.7	3.9	4.9	12.2	11.1	1.2	2.5
-LH-	6.4	7.8	7.1	6.8	4.4	3.5	8.0	7.1
- -HL	9.7	13.1	12.9	10.7	4.2	5.2	13.9	17.9
LLH-	1.2	1.0	1.2	1.2	3.2	2.3	0.2	0.0
L-HL	1.9	1.9	2.2	2.0	3.3	3.7	1.2	2.0
-LHL	2.8	3.1	3.1	2.9	2.1	1.9	3.3	2.4
Total H	62.3	54.6	52.5	59.7	45.1	42.3	67.4	53.1
M-M-	2.5	2.4	2.4	2.5	7.2	9.2	0.0	0.0
-MM-	3.4	5.3	5.2	4.0	2.6	0.0	4.8	3.2
- -MM	5.2	9.4	7.1	6.2	1.1	3.0	8.5	11.8
MLM-	0.5	0.8	1.1	0.6	1.8	3.5	0.0	0.0
L-MM	0.5	0.3	1.3	0.6	0.4	0.7	0.6	3.4
-MML	1.0	1.5	0.9	1.1	0.0	0.0	1.4	1.0
-LML	0.9	0.9	1.7	1.0	0.0	0.0	1.4	1.7
LLM-	3.1	2.7	2.1	2.9	8.8	5.4	0.0	0.0
L-ML	1.7	2.9	2.4	2.0	4.5	5.9	0.0	4.6
-LML	3.5	4.4	7.0	4.2	1.6	2.1	5.5	4.9
Total M	27.2	36.4	36.5	30.6	40.0	38.8	23.3	35.5
LLLL	1.3	0.5	0.8	1.2	3.1	3.5	0.1	0.3
Percent in Each Pattern, with OTHER as PRIMARY WORK ACTIVITY								
- - -X	39.1	38.9	37.9	37.7	20.8	16.3	42.3	39.0
L- -H	5.4	5.7	5.3	5.4	6.8	3.8	4.6	13.9
-L-H	8.6	8.9	12.2	9.6	9.8	11.5	9.9	3.4
- -LH	12.5	14.0	11.4	12.5	3.9	6.3	15.0	9.1
LL-H	1.1	2.4	1.5	1.5	3.5	4.2	0.0	2.3
L-LH	1.7	2.3	2.9	2.1	1.6	1.0	2.2	4.4
-LLH	3.1	5.9	4.2	3.9	2.3	0.0	4.6	1.3
Total H	71.5	73.1	75.4	72.7	48.7	43.1	78.6	73.4
M- -M	1.0	1.2	1.2	1.1	4.4	5.2	0.0	0.8
-M-M	4.0	3.4	3.2	3.7	6.4	4.9	3.1	2.5
- -MM	3.4	3.3	3.1	3.3	2.7	2.1	3.4	3.6
-MLM	1.4	0.3	0.3	0.9	0.8	0.0	1.0	0.5
LL-M	2.2	3.3	1.9	2.3	10.1	5.6	0.4	1.6
L-LM	1.9	0.4	2.0	1.6	3.5	6.6	1.1	1.3
-LLM	3.9	5.4	3.7	4.1	3.5	3.1	4.6	0.4
LLLM	2.3	2.2	2.1	2.2	7.6	4.5	0.8	3.6
Total M	20.1	19.5	17.5	19.2	39.0	32.0	14.4	14.3
LLLL	0.3	0.4	0.1	0.3	1.4	0.0	0.1	0.1

[1] The codes indicate the percent of time in each activity in the order: teaching (T), research (R), administration (A), and other activity (O). X indicates 100 percent of time was spent in that particular activity; H, 70 to 99 percent; M, 40 to 69 percent; and L, 1 to 39 percent.

APPENDIX B

Primary Work Activity Patterns of Doctoral Scientists and Engineers
1973-1977

TABLE B.1 Primary Work Activity Patterns by Cohort, Field of Doctorate, and Sex, for Doctoral Scientists and Engineers Employed in Academe, 1973-1977[1]

Primary Work Activity Pattern by S.D. Field Group, 1973–1977	1934 to 1945			1946 to 1956			1957 to 1966			1967 to 1969			1970 to 1972			Total 1934 to 1972		
	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both
EMP FIELDS	1,138	41	1,179	4,674	170	4,844	9,987	308	10,295	4,989	221	5,210	4,292	260	4,552	25,080	1,000	26,080
Constant, 1973-1977	69.4	90.2	70.1	73.6	82.4	73.9	67.8	74.4	68.0	73.0	71.0	72.9	73.1	71.9	73.0	70.9	75.0	71.0
Teaching	48.4	73.2	49.3	52.4	62.9	52.5	52.4	56.2	52.5	57.6	55.2	57.5	51.9	51.5	51.9	53.2	56.6	53.3
Research	10.7	14.6*	10.9	7.4	6.5*	7.4	8.6	14.6	8.8	11.8	14.9	11.9	18.4	17.3	18.4	10.8	14.0	10.9
Administration	10.3		9.9	13.5	6.5*	13.3	6.3	2.9*	6.2	3.2	(0.9)	3.1	1.7	(1.5)	1.7	6.4	2.6	6.3
Other Activity		(2.4)	(0.1)	(0.3)	(6.5)	0.6*	0.5*	(0.6)	0.5	0.4*		0.4*	1.1*	(1.5)	1.1*	0.5	1.8*	0.6
Switched, 1973-1977	30.6	9.8*	29.9	26.4	17.6	26.1	32.2	25.6	32.0	27.0	29.0	27.1	26.9	28.1	27.0	29.1	25.0	29.0
Into Teaching	10.2	(2.4)	9.9	6.6	3.5*	6.5	9.6	8.8	9.6	7.4	8.6	7.4	11.0	12.7	11.1	8.9	8.6	8.9
Out of Teaching	13.1	(7.3)	12.9	13.1	8.8*	13.0	17.6	11.7	17.4	14.9	14.5	14.9	11.4	11.2	11.4	15.0	11.5	14.8
Into Research	7.5		7.2	7.9	4.7*	7.8	9.8	6.8	9.7	9.4	7.2	9.3	7.0	8.8	7.1	8.8	6.8	8.7
Out of Research	4.4*	(2.4)	4.3*	6.5	4.1*	6.4	7.6	6.5	7.6	9.9	10.9	9.9	13.3	11.5	13.2	8.7	8.2	8.7
Into Administration	7.5		7.2	8.6	5.9*	8.5	9.2	6.2	9.1	6.7	6.3	6.7	5.0	1.9*	4.8	7.8	4.8	7.7
Out of Administration	9.6		9.2	4.6	(0.6)	4.5	4.5	3.9*	4.4	1.1*	(1.8)	1.2	0.7*	1.9*	0.8*	3.4	2.2	3.4
Into Other Activity	5.0	(2.4)	4.9	2.1	(2.4)	2.1	2.2	3.2*	2.2	2.1	4.5*	2.2	2.8	3.8*	2.8	2.4	3.5	2.4
Out of Other Activity	1.5*		1.4*	1.3*	(3.5)	1.4	1.6	3.2*	1.7	0.4*	1.8*	0.4*	0.9*	1.9*	1.0	1.2	2.5	1.2
LIFE SCIENCES	905	62	967	3,862	266	4,128	6,335	646	6,981	3,105	400	3,505	3,270	605	3,875	17,477	1,979	19,456
Constant, 1973-1977	62.7	61.3	62.6	65.7	74.1	66.3	66.2	68.1	66.4	67.0	68.5	67.2	67.5	57.9	66.0	66.3	65.6	66.2
Teaching	32.9	50.0*	34.0	33.2	45.5	34.0	34.9	37.5	35.2	35.2	39.8	35.7	36.5	28.1	35.2	34.8	36.6	35.0
Research	18.5	(11.3)	18.0	21.5	22.6	21.6	23.0	27.6	23.4	27.2	28.0	27.3	27.5	28.4	27.7	24.0	26.7	24.3
Administration	9.5		8.9	10.5	6.0*	10.2	6.5	2.8	6.2	3.0	(0.8)	2.7	1.3	(0.3)	1.1	5.9	2.0	5.5
Other Activity	1.8*		1.7*	0.5*		0.5*	1.8	(0.3)	1.7	1.5*		1.4*	2.2	(0.8)	2.0	1.5	0.4*	1.4
Switched, 1973-1977	37.3	38.7*	37.4	34.3	25.9	33.7	33.8	31.9	33.6	33.0	31.5	32.8	32.5	42.1	34.0	33.7	34.4	33.8
Into Teaching	7.5		7.0	10.1	5.3*	9.8	9.8	10.1	9.8	8.7	9.5	8.8	13.2	20.3	14.3	10.2	12.1	10.4
Out of Teaching	15.0	32.3*	16.1	14.6	6.4*	14.1	14.2	12.2	14.0	13.2	15.8	13.5	10.2	14.0	10.8	13.4	13.5	13.4
Into Research	9.7		9.1	10.2	(3.0)	9.7	9.0	7.6	8.9	10.7	10.5	10.7	9.7	12.2	10.1	9.7	8.7	9.6
Out of Research	9.2		8.6	9.5	10.2*	9.5	12.9	11.6	12.8	11.8	13.8	12.0	14.5	20.5	15.4	12.1	14.2	12.3
Into Administration	12.7	27.4*	13.7	9.1	9.8*	9.2	8.9	7.9	8.8	7.3	6.8	7.2	5.4	5.5	5.4	8.2	7.8	8.2
Out of Administration	6.2	(6.5)	6.2	5.9	3.8*	5.8	3.8	4.5	3.9	4.2	(1.0)	3.8	3.9	5.3	4.1	4.5	4.0	4.4
Into Other Activity	3.5*	(6.5)	3.7*	3.3	6.8*	3.5	3.6	5.3	3.8	4.9	4.8*	4.9	3.3	3.3*	3.3	3.7	4.8	3.8
Out of Other Activity	3.4*		3.2*	2.7	(2.6)	2.7	1.3	1.9*	1.4	2.0		1.8	2.4	1.3*	2.2	2.1	1.4	2.0
BEHAVIORAL SCIENCES	456	72	528	2,901	244	3,145	5,440	711	6,151	2,761	485	3,246	3,600	696	4,296	15,158	2,208	17,366
Constant, 1973-1977	62.3	76.4	64.2	66.6	61.1	66.1	62.9	64.6	63.1	67.0	66.6	66.9	69.3	73.6	69.9	65.8	67.8	66.1
Teaching	49.1	70.8	52.1	47.9	47.5	47.9	49.6	52.2	49.9	53.0	54.6	53.3	61.6	67.2	62.5	52.7	57.6	53.3
Research	4.6*	(5.6)	4.7*	7.5	6.1*	7.4	4.9	4.8	4.9	9.5	6.6	9.1	4.3	3.4*	4.2	6.1	4.9	5.9
Administration	7.5*		6.4*	10.9	6.6*	10.6	7.6	4.9	7.3	3.2	2.9*	3.2	1.9*	(1.6)	1.7	6.1	3.1	5.7
Other Activity	(1.3)		(0.9)	(0.3)	(0.8)	(0.3)	0.8*	2.7*	1.1	1.2	2.5*	1.4*	1.5*	2.3*	1.6	1.0	2.2	1.1
Switched, 1973-1977	37.7	23.6*	35.8	33.4	38.9	33.9	37.1	35.4	36.9	33.0	33.4	33.1	30.8	26.4	30.1	34.2	32.2	33.9
Into Teaching	11.8*	9.7*	11.6	10.8	10.7*	10.7	12.2	7.2	11.6	7.3	5.8	7.1	7.6	8.9	7.8	9.9	7.9	9.7
Out of Teaching	13.2	13.9*	13.3	15.1	20.9	15.5	18.5	20.8	18.7	19.8	20.8	20.0	19.4	13.1	18.4	18.1	18.2	18.1
Into Research	9.0*	(5.6)	8.5*	7.0	7.4*	7.0	6.0	5.6	6.0	7.8	6.4*	7.6	8.7	5.6	8.2	7.3	6.0	7.1
Out of Research	9.6*	(4.2)	8.9*	6.1	6.6*	6.1	8.1	3.9	7.6	5.3	6.2	5.5	7.1	6.2	7.0	7.0	5.4	6.8
Into Administration	6.4*	(4.2)	6.1*	9.7	11.1*	9.8	10.5	11.5	10.6	8.9	13.8	9.6	9.1	7.0	8.8	9.6	10.3	9.7
Out of Administration	6.1*		5.3*	8.1	7.4*	8.0	7.4	5.5	7.2	4.3	1.9*	3.9	1.3*	3.2*	1.8	5.5	4.0	5.3
Into Other Activity	4.4*	(4.2)	4.4*	4.5	5.7*	4.6	5.6	7.7	5.8	6.8	3.5*	6.3	3.9	4.5*	4.0	5.2	5.4	5.2
Out of Other Activity	3.1*	(2.8)	3.0*	1.1*		1.0*	1.9	3.7	2.1	2.1*	3.3*	2.2	1.9	2.7*	2.0	1.8	2.9	1.9

[1] Numbers shown in the table are weighted n's. Where weighted n's or percentages are based on fewer than 3 individuals, they are enclosed in parentheses; where based on 3 to 9 individuals, they are marked with an asterisk.

TABLE B.2 Primary Work Activity Patterns by Cohort, Field of Doctorate, and Sex, for Doctoral Scientists and Engineers Employed in Business/Industry, 1973-1977[1]

Primary Work Activity Pattern by Ph.D. Field Group, 1973-1977	1934 to 1945			1946 to 1956			1957 to 1966			1967 to 1969			1970 to 1972			Total 1934 to 1972		
	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both
EMP FIELDS	1,236	12	1,248	4,925	54	4,979	6,972	65	7,037	3,949	40	3,989	3,232	35	3,267	20,314	206	20,520
Constant, 1973-1977	69.6	66.7*	69.6	72.6	68.5	72.6	64.7	56.9	64.7	57.6	65.0	57.6	51.4	77.1	51.7	63.4	65.5	63.4
Research	13.9	(16.7)	13.9	16.5	35.2	16.7	21.8	35.4	22.0	24.8	40.0	25.0	24.1	51.4	24.4	21.0	37.9	21.2
Administration	41.1	(16.7)	40.9	44.4	22.2*	44.1	30.0	(6.2)	29.8	18.6	(5.0)	18.5	8.5	(2.9)	8.4	28.5	10.2	28.3
Other Activity	14.6	(33.3)	14.7	11.7	(11.1)	11.7	12.9	15.4*	12.9	14.1	20.0*	14.2	18.8	22.9*	18.8	13.9	17.5	13.9
Switched, 1973-1977	30.4	33.3*	30.4	27.4	31.5*	27.4	35.3	43.1	35.3	42.4	35.0	42.4	48.6	22.9*	48.3	36.6	34.5	36.6
Into Teaching				(0.3)		(0.3)	(0.1)		(0.1)							0.1*		0.1*
Out of Teaching							(0.1)		(0.1)	(0.2)		(0.2)						
Into Research	6.8		6.7	9.1	(3.7)	9.0	8.6	(3.1)	8.6	7.1	(5.0)	7.1	7.6	(2.9)	7.6	8.2	3.4*	8.1
Out of Research	3.9*	(25.0)	4.1*	5.3	(9.3)	5.3	13.6	23.1	13.7	20.3	20.0*	20.3	23.7	20.0*	23.7	13.9	18.4	14.0
Into Administration	7.5		7.5	6.3	20.4*	6.4	14.9	23.1	15.0	20.4	25.0*	20.4	23.6	(5.7)	23.4	14.8	18.4	14.8
Out of Administration	17.6	(8.3)	17.5	13.8	(3.7)	13.7	9.7	12.3*	9.7	7.4	(2.5)	7.3	7.1		7.0	10.3	5.8*	10.3
Into Other Activity	15.4	33.3*	15.5	10.9	7.4*	10.9	11.0	16.9*	11.1	14.2	(2.5)	14.1	15.9	14.3*	15.9	12.7	12.1	12.7
Out of Other Activity	8.3		8.2	7.6	16.7*	7.7	10.5	7.7*	10.5	14.1	10.0*	14.0	17.1	(2.9)	17.0	11.4	9.2	11.4
LIFE SCIENCES	189	13	202	845	21	866	1,248	47	1,295	487	12	499	417	23	440	3,186	116	3,302
Constant, 1973-1977	66.1	76.9*	66.8	72.1	85.7*	72.4	63.3	70.2	63.6	59.3	75.0*	59.7	44.8	56.5*	45.5	62.8	71.6	63.1
Teaching		(30.8)	(2.0)														3.4	0.1
Research	(4.2)		(4.0)	10.5	(19.0)	10.7	14.5	36.2*	15.3	18.7	75.0*	20.0	13.9	(21.7)	14.3	13.4	30.2	14.0
Administration	28.0		26.2	48.8		47.6	38.4	23.4*	37.8	31.8		31.1	12.0*		11.4*	36.1	9.5*	35.1
Other Activity	33.9	(46.2)	34.7	12.8	66.7*	14.1	10.4	10.6*	10.4	8.8*		8.6*	18.9	(34.8)	19.8	13.3	28.4	13.8
Switched, 1973-1977	33.9	(23.1)	33.2	27.9	(14.3)	27.6	36.7	29.8*	36.4	40.7	(25.0)	40.3	55.2	43.5*	54.5	37.2	28.4	36.9
Out of Teaching														(17.4)	(0.9)		(3.4)	(0.1)
Into Research	(4.2)		(4.0)	8.5	(14.3)	8.7	7.7	14.9*	8.0	8.4*		8.2*	3.8*		3.6*	7.3	8.6*	7.4
Out of Research				5.2		5.1	11.9	14.9*	12.0	15.4	(25.0)	15.6	30.0	(21.7)	29.5	12.3	12.9*	12.4
Into Administration	10.6*		9.9*	8.0		7.9	18.3	(8.5)	18.0	21.6	(25.0)	21.6	23.5	30.4*	23.9	16.3	12.1*	16.2
Out of Administration	14.8*	(23.1)	15.3*	14.2		13.9	11.8	8.5*	11.7	15.8		15.4	10.3*		9.8*	13.0	6.0*	12.8
Into Other Activity	12.7*	(23.1)	13.4*	9.5		9.2	9.6	(6.4)	9.5	9.9*		9.6*	23.3	(13.0)	22.7	11.6	7.8*	11.4
Out of Other Activity	16.9*		15.8*	7.1	(14.3)	7.3	11.5	(6.4)	11.3	8.6*		8.4*	13.9	(4.3)	13.4	10.5	6.0*	10.4
BEHAVIORAL SCIENCES	75	10	85	537	40	577	521	53	574	238	31	269	190	41	231	1,561	1[illegible]	1,736
Constant, 1973-1977	72.0	100.0*	75.3	82.3	92.5	83.0	68.3	71.7	68.6	71.0	87.1*	72.9	51.6	97.6	59.7	71.7	86.9	73.2
Research				5.8*		5.4*	8.6*	(7.5)	8.5*	10.1*		8.9*	(7.4)	19.5*	9.5*	7.3	6.9*	7.3
Administration	22.7*		20.0*	28.5		26.5	18.0	11.3*	17.4	13.9	(6.5)	13.0*	(7.9)	(7.3)	7.8*	20.0	6.3*	18.6
Other Activity	49.3	100.0*	55.3	48.0	92.5	51.1	41.7	52.8	42.7	47.1	80.6*	50.9	36.3	70.7*	42.4	44.4	73.7	47.4
Switched, 1973-1977	28.0*		24.7*	17.7	(7.5)	17.0	31.7	28.3*	31.4	29.0	(12.9)	27.1	48.4	(2.4)	40.3	28.3	13.1*	26.8
Into Teaching											(12.9)	(1.5)					(2.3)	(0.2)
Out of Teaching							(1.2)		(1.0)	(2.9)		(2.6)				(0.8)		(0.7)
Into Research	(10.7)		(9.4)	6.1*		5.7*	7.3*	(3.8)	7.0*	8.8*		7.8*	20.0*	(2.4)	16.9*	8.8	(1.7)	8.1
Out of Research	(8.0)		(7.1)	(1.3)		(1.2)	7.5*	(1.9)	7.0*	(2.5)		(2.2)	(7.9)		(6.5)	4.7	(0.6)	4.3
Into Administration				(1.3)	(7.5)	(1.7)	7.5*	(3.8)	7.1*	10.9*		9.7*	12.1*		10.0*	6.1	(2.9)	5.8
Out of Administration	20.0*		17.6*	9.1*		8.5*	14.2	(7.5)	13.6	15.1*		13.4*	16.3*	(2.4)	13.9*	13.1	(2.9)	12.1
Into Other Activity	(17.3)		(15.3)	10.2*		9.5*	15.5	20.8*	16.0	(6.3)		(5.6)	16.3*		13.4*	12.5	6.3*	11.9
Out of Other Activity				4.3*	(7.5)	4.5*	7.9*	(3.8)	7.5*	8.4*	(12.9)	8.9*	24.2*		19.9*	8.3	5.1*	8.0

[1] Numbers shown in the table are weighted n's. Where weighted n's or percentages are based on fewer than 3 individuals, they are enclosed in parentheses; where based on 3 to 9 individuals, they are marked with an asterisk.

TABLE B.3 Primary Work Activity Patterns by Cohort, Field of Doctorate, and Sex, for Doctoral Scientists and Engineers Employed in U.S. Government, 1973-1977[1]

Primary Work Activity Pattern by Ph.D. Field Group, 1973-1977	1934 to 1945			1946 to 1956			1957 to 1966			1967 to 1969			1970 to 1972			Total 1934 to 1972		
	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both	Men	Women	Both
EMPFIELDS	124	6*	130	666	27	693	1,370	33	1,403	856	17	873	1,058	26	1,084	4,074	109	4,183
Constant, 1973-1977	58.9	100.0*	60.8	71.2	59.3	70.7	73.1	66.7	73.0	67.4	70.6*	67.5	59.3	61.5	59.3	67.6	66.1	67.5
Teaching										(0.5)	.	(0.5)				(0.1)		(0.1)
Research	26.6*	(33.3)	26.9*	29.1	25.9*	29.0	34.5	60.6	35.1	41.8	41.2*	41.8	27.6	46.2*	28.0	33.1	44.0	33.4
Administration	32.3*	(66.7)	33.8*	39.5	22.2*	38.8	34.4	(6.1)	33.7	21.3	29.4*	21.4	25.7		25.1	30.1	15.6	29.8
Other Activity				(2.6)	(11.1)	2.9*	4.3		4.2	3.9*		3.8*	6.0*	(15.4)	6.2	4.2	6.4*	4.3
Switched, 1973-1977	41.1*		39.2*	28.8	40.7*	29.3	26.9	33.3*	27.0	32.6	29.4*	32.5	40.7	38.5*	40.7	32.4	33.9	32.5
Into Teaching							(0.4)		(0.4)	(0.9)	(11.8)	(1.1)	2.3*		2.2*	0.9*	(1.8)	0.9*
Out of Teaching							1.3*		1.3*				4.2*		4.1*	1.5*		1.5*
Into Research	13.7*		13.1*	9.3*	40.7*	10.5	6.0	(3.0)	5.9	7.1*		7.0*	7.7	(7.7)	7.7	7.4	12.8*	7.6
Out of Research	14.5*		13.8*	12.5		12.0	13.4	21.2*	13.6	16.4	23.5*	16.5	18.6	26.9*	18.8	15.3	16.5	15.3
Into Administration	(6.5)		(6.2)	9.6*		9.2*	12.6	15.2*	12.6	15.4	(11.8)	15.3	19.3	19.2*	19.3	14.2	11.0	14.2
Out of Administration	26.6*		25.4*	12.0	11.1*	12.0	8.4	(6.1)	8.3	7.4*		7.2*	8.7		8.5	9.4	4.6*	9.3
Into Other Activity	21.0*		20.0*	9.9		9.5	6.4	15.2*	6.6	8.2	(5.9)	8.1	8.6	(7.7)	8.6	8.3	7.3*	8.3
Out of Other Activity				(2.4)	(29.6)	3.5*	3.0*	(3.0)	3.0*	8.9	(5.9)	8.8	8.0	11.5*	8.1	5.4	11.9*	5.5
LIFE SCIENCES	100	(9)	109	738	33*	771	1,076	67	1,143	566	17*	583	573	33*	606	3,053	159	3,212
Constant, 1973-1977	84.0	(66.7)	82.6	73.6	87.9	74.2	75.4	86.6	76.0	76.5	70.6*	76.3	71.0	81.8*	71.6	74.6	83.0	75.0
Teaching				(0.5)	(9.1)	(0.9)	(0.3)		(0.3)							(0.2)	(1.9)	0.3*
Research	24.0*	(66.7)	27.5*	40.2	45.5*	40.5	56.4	64.2	56.9	61.5	58.8*	61.4	53.9	48.5*	53.6	51.9	56.6	52.1
Administration	60.0		55.0	30.6	33.3*	30.7	18.1	19.4*	18.2	12.4	(11.8)	12.3	12.9	33.3*	14.0	20.5	23.3	20.6
Other Activity				2.2*		2.1*	(0.6)	(3.0)	(0.7)	2.7*		2.6*	4.2*		4.0*	2.0	(1.3)	2.0
Switched, 1973-1977	16.0*	(33.3)	17.4*	26.4	(12.1)	25.8	24.6	13.4*	24.0	23.5	(29.4)	23.7	29.0	(18.2)	28.4	25.4	17.0	25.0
Out of Teaching							(0.7)		(0.6)				(0.7)		(0.7)	(0.4)		(0.3)
Into Research				9.6		9.2	7.0	7.5*	7.0	7.2*		7.0*	4.5*		4.[illegible]	7.0	3.1*	6.8
Out of Research	(4.0)	(33.3)	(6.4)	9.0	(12.1)	9.9	15.1	(1.5)	14.3	11.8	(11.8)	11.8	19.7	(18.2)	19.6	13.7	10.1*	13.5
Into Administration	(8.0)	(33.3)	10.1*	11.9		11.4	12.7	(1.5)	12.1	9.5	(11.8)	9.6	19.4	(6.1)	18.6	13.0	(5.0)	12.6
Out of Administration	(8.0)		(7.3)	12.3		11.8	7.0	(6.0)	6.9	10.4	(17.6)	10.6	3.8*		3.6*	8.4	4.4*	8.2
Into Other Activity	(8.0)		(7.3)	4.9*		4.7*	4.6	(3.0)	4.5	6.7*	(17.6)	7.0*	2.8*	(12.1)	3.3*	4.8	5.7*	4.9
Out of Other Activity	(4.0)		(3.7)	2.2*		2.1*	1.6*	(3.0)	1.7*	(0.5)		(0.5)	4.7*		4.5*	2.2	(1.3)	2.1
BEHAVIORAL SCIENCES	(20)		(20)	256	20*	276	396	34*	430	178	16*	194	153	9*	162	1,003	79	1,082
Constant, 1973-1977	(65.0)		(65.0)	77.7	85.0*	78.3	69.7	61.8*	69.1	73.0	37.5*	70.1	62.7	100.0*	64.8	71.2	67.1	70.9
Teaching								(8.9)	(0.7)	(3.9)		(3.6)				(0.7)	(3.8)	(0.9)
Research				16.0*		14.9*	19.4	(14.[illegible])	19.1	28.7*	(18.8)	27.8*	17.0*		16.0*	19.4	(10.1)	18.8
Administration	(30.0)		(30.0)	55.5	35.0*	54.0	40.7	29.4*	39.8	26.4*	(18.8)	25.8*	30.1*	66.7*	32.1	40.1	32.9	39.6
Other Activity	(35.0)		(35.0)	(6.3)	50.0*	9.4*	9.6*	(8.8)	9.5*	14.0*		12.9*	15.7*	(33.3)	16.7*	11.0	20.3*	11.6
Switched, 1973-1977	(35.0)		(35.0)	22.3*	(15.0)	21.7*	30.3	38.2*	30.9	27.0*	62.5*	29.9	37.3*		35.2*	28.8	32.9*	29.1
Into Teaching				(2.7)		(2.5)										(0.7)		(0.6)
Out of Teaching				(3.5)		(3.3)	(1.8)		(1.6)							(1.6)		(1.5)
Into Research							(3.0)	(17.6)	4.2*	11.8*		10.8*	13.7*		13.0*	5.4*	(7.6)	5.5
Out of Research	(35.0)		(35.0)	(6.6)		(6.2)	4.8*	(2.9)	4.7*	(3.4)	(18.8)	(4.6)	14.4*		13.6*	7.1	(5.1)	6.9
Into Administration				(6.6)		(6.2)	11.6	(11.8)	11.6	11.2*	62.5*	15.5*	13.7*		13.0*	10.4	17.7*	10.9
Out of Administration				(6.3)		(5.8)	15.2*	(17.6)	15.3	15.7*		14.4*	(4.6)		(4.3)	11.1	(7.6)	10.8
Into Other Activity	(35.0)		(35.0)	12.9*	(15.0)	13.0*	15.7*	(8.8)	15.1	(3.9)		(3.6)	(9.8)		(9.3)	12.4	(7.6)	12.0
Out of Other Activity							(3.0)	(17.6)	4.2*	(7.9)	(43.8)	10.8*	18.3*		17.3*	5.4*	16.5*	6.2

[1] Numbers shown in the table are weighted n's. Where weighted n's or percentages are based on fewer than 3 individuals, they are enclosed in parentheses; where based on 3 to 9 individuals, they are marked with an asterisk.

APPENDIX C

Questionnaire and Specialties List
1973 Survey of Doctoral Scientists and Engineers

SURVEY OF DOCTORAL SCIENTISTS AND ENGINEERS

OMB No. 99-S7300I
Approval expires Dec. 31, 1975

CONDUCTED BY THE NATIONAL RESEARCH COUNCIL WITH THE SUPPORT OF THE NATIONAL SCIENCE FOUNDATION

The letter on the adjacent page requests that you assist in this survey of doctoral scientists and engineers -- including the fields of the natural and social sciences, mathematics, and engineering.

Please print or type your answers on this first page. If selected information has been printed by computer, check to be certain the entries are CORRECT and COMPLETE. The second page has special instructions. After the form has been completed, please return it in the enclosed envelope to: Manpower Studies Branch, Office of Scientific Personnel, National Research Council, 2101 Constitution Avenue, Washington, D. C. 20418.

NOTE: ALL INFORMATION IS REGARDED AS CONFIDENTIAL AND WILL BE USED FOR STATISTICAL PURPOSES ONLY. IT WILL NOT BE RELEASED IN ANY WAY THAT WILL ALLOW IT TO BE IDENTIFIED WITH YOU.

If your name and address are incorrect, please enter correct information to the right. Include zip code.

(10)

(29)

If there is an alternate address through which you could be reached, please provide it in the space below.

C/O Number Street City State Zip Code (11)

VITA

1 Date of Birth (12-16) Mo. Day Yr.

2 State or Foreign Country of Birth (17-18)

3 State or Foreign Country of Secondary School Graduation (19-20)

4 Sex: (21) ☐ 1 Male ☐ 2 Female

5 Citizenship (22) ☐ 0 USA ☐ 1 Non-USA (specify country) _____

6 Social Security No. (23-31)

7 Race (32) (Please check one) ☐ 0 White/Caucasian ☐ 1 Black/Negro ☐ 2 American Indian ☐ 3 Asian, specify _____ ☐ 4 Other, specify _____

8 Ethnic Group (33) (Please check one) ☐ 0 Puerto Rican American ☐ 1 Mexican American/Chicano ☐ 2 Spanish American ☐ 3 Afro-American ☐ 4 None of these (Please specify any other) _____

9 List in the table below all collegiate and graduate degrees that have been awarded to you; e.g., BA/BS, MA/MS, PhD. If some information has been entered by computer, please be sure it is CORRECT and COMPLETE (including the number and name of the specialty field from the list on the reverse side).

Type of Degree	Granted Mo.	Granted Yr.	Major Field (Use Specialties List) Name	Major Field (Use Specialties List) Number	Institution Name	City (or campus) and State
BS						
MS						
PhD						

10 Name of your doctoral thesis advisor: (23-44)
(please print FULL name) (First Name) (Middle Initial) (Last Name)

PROFESSIONAL EMPLOYMENT

11 Please give the name of your present principal employer (organization, company, etc. or, if self employed, "self"), and actual place of employment.

Name of present principal employer (45-50) Actual place of employment (city, state and zip code) (51-55)

If employed by a university, college, or junior college, please check the rank of your present position: (56)

☐ 0 Professor ☐ 1 Associate Professor ☐ 2 Assistant Professor ☐ 3 Instructor ☐ 4 Lecturer ☐ 5 Other, specify _____

12 Please give the basic annual salary associated with your principal professional employment in 1972 and 1973. If you were on a postdoctoral appointment (e.g., fellowship, traineeship, research associateship) give your annual stipend plus allowances below.

1972 $ _____ (57-59) 1973 $ _____ (60-62)

If academically employed, check whether salary is for:

	1972	1973
9-10 mos	☐ (63)	☐ (64)
11-12 mos	☐	☐

(Basic Annual Salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work.)

PLEASE CONTINUE

Please Do Not Write In This Space

1 1 29 ctr # C
10 11
V
12 13 14 15 16
17 18 19 20
21 22 23-31 SS #
32 33
B
34 35 36
37 38 39
40 41 42 43 44 45
M
46 47 48
49 50 51
52 53 54 55 56 57
D
58 59 60
61 62 63 64 65 66
67 68 69 70 71 72
C
2 29 ctr #
O
10 11 12 13
14 15 16
17 18 19 20 21 22
23-44 Th Ad
E
45 46 47 48 49 50
51 52 53 54 55 56
57 58 59 60 61 62
63 64

PLEASE READ DIRECTIONS ON ADJACENT PAGE.

13. **What is your employment status?**

	1972	1973
Employed full-time, science or engineering related position	○	○
Employed full-time, nonscience or nonengineering related position. (Complete 13a below)	○	○
Employed part-time, science or engineering related position (Complete 13b below)	○	○
Employed part-time, nonscience or nonengineering related position (Complete 13b below)	○	○
Postdoctoral appointment (fellowship, traineeship, research associateship, etc.) Complete 13c below	○	○
Unemployed and seeking employment	○	○
Specify number of months unemployed ___ ___		
Unemployed and not seeking employment	○	○
Retired and not seeking employment	○	○
Specify year of retirement ___ ___		
Other, specify _____	○	○

13a. **If you are employed full-time in 1973 in a position unrelated to science or engineering, what was the MOST important reason for taking the position?**

	1973
Prefer nonscience or nonengineering position	○
Promoted out of science or engineering position	○
Pay is better	○
Locational preference	○
Science or engineering position not available	○
Other, specify _____	○

13b. **If employed part-time in 1973, are you seeking full-time employment?**

	1973
Yes	○
No	○

13c. **If on postdoctoral appointment in 1973, what was the MOST important reason for taking the appointment?**

	1973
Sought additional research experience in field	○
Opportunity to change to another field	○
Employment position not available	○
Other, specify _____	○

14. **If employed or on a postdoctoral appointment in 1973, please indicate the term of employment or appointment:**

	1973
Three months or less	○
More than 3 months, not more than one year	○
More than one year, not more than 3 years	○
More than 3 years, not more than 5 years	○
Permanent or tenured position	○

15. **Which categories best describe the sector of the economy and type of organization of your principal employer or postdoctoral affiliation?**

	1972	1973
A. **Sector:** Public	○	○
Private	○	○
B. **Type of organization:**		
Business or industry	○	○
Junior college, 2-year college, technical institute	○	○
Medical school	○	○
4-year college or university, other than medical school	○	○
Elementary or secondary school system	○	○
Hospital or clinic	○	○
U.S. military service, active duty, or Commission Corps., e.g., USPHS, NOAA	○	○
U.S. government, civilian employee	○	○
State government	○	○
Local or other government, specify _____	○	○
International agency	○	○
Non-profit organization, other than hospital, clinic, or educational institution	○	○
Other, specify _____	○	○

16. **What are the primary (A) and secondary (B) work activities related to your position?**

	1972 A	1972 B	1973 A	1973 B
Management or administration of:				
Research and development	○	○	○	○
Other than research and development	○	○	○	○
Both	○	○	○	○
Basic research	○	○	○	○
Applied research	○	○	○	○
Development of equipment, products, systems, data	○	○	○	○
Design	○	○	○	○
Teaching	○	○	○	○
Report or other technical writing, editing	○	○	○	○
Production	○	○	○	○
Consulting, specify _____	○	○	○	○
Professional services to individuals	○	○	○	○
Quality control, inspection, testing	○	○	○	○
Sales, marketing, purchasing, estimating	○	○	○	○
Other, specify _____	○	○	○	○

17. **From the specialties list on the adjacent page, select and enter both the number and title of the scientific specialty most closely related to your principal employment or postdoctoral appointment. Write in your specialty if it is not on the list.**

1972 [ ][ ][ ] Number _____

1973 [ ][ ][ ] Number _____

18. **Is ANY of your work being supported or sponsored by U.S. government funds?**

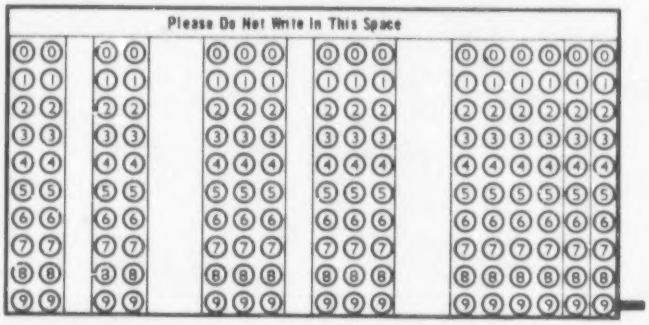
	Yes	No	Don't Know
1972	○	○	○
1973	○	○	○

If yes, which of the following federal agencies or departments are supporting the work? (Mark all that apply.)

	1972	1973		1972	1973
NASA	○	○	Dept. of Defense	○	○
NSF	○	○	Dept. of Commerce	○	○
EPA	○	○	Dept. of Agriculture	○	○
AEC	○	○	Dept. of Transportation	○	○
AID	○	○	Dept. of Justice	○	○
Dept. of Health, Educ., & Welfare			Dept. of Housing and Urban Development	○	○
NIH	○	○	Dept. of Interior	○	○
Health Services & Mental Health Admin.	○	○	Other agency or dept., specify _____	○	○
Office of Educ.	○	○			
Other HEW, specify _____	○	○	Don't know source	○	○

This is the end of the questionnaire. Thank you.

Please Do Not Write In This Space



DIRECTIONS: Your responses to this portion of the questionnaire will be read by an optical mark reader. Your careful observance of these few simple rules will be most appreciated.

- **Use only black lead pencil (No. 2½ or less).**
- **Make heavy black marks that fill the circle.**
- **Erase cleanly any answer you wish to change.**
- **Make no stray markings of any kind.**

EXAMPLE:

Will marks made with ball pen, felt tip, or fountain pen be properly read?

Yes	No
○	●

PLEASE NOTE that we are requesting that you furnish the following information for both the current year, as of the time you receive this form, and last year, as of March 31, 1972. Fill in the category of each item which most appropriately describes your status in 1972 and 1973. Unless otherwise specified, mark only one category in each year.

SPECIALTIES LIST

MATHEMATICAL SCIENCES

000 Algebra
010 Analysis & Functional Analysis
020 Geometry
030 Logic
040 Number Theory
052 Probability
055 Math. Statistics (see also 544, 670, 725, 729)
060 Topology
080 Computing Theory & Practice
082 Operations Research (see also 477)
085 Applied Mathematics
089 Combinatorics & Finite Mathematics
091 Physical Mathematics
098 Mathematics, General
099 Mathematics, Other*

ASTRONOMY

101 Astronomy
102 Astrophysics

PHYSICS

110 Atomic & Molecular Physics
120 Electromagnetism
130 Mechanics
132 Acoustics
134 Fluids
135 Plasma Physics
136 Optics
138 Thermal Physics
140 Elementary Particles
150 Nuclear Structure
160 Solid State
198 Physics, General
199 Physics, Other*

CHEMISTRY

List A	List B
Fields used to classify academic degrees. Use for Item 9 on questionnaire. Also see note below.	Fields used to classify present professional employment. Use for Item 17 on questionnaire. Also see note below for the doctoral field in Item 9.
200 Analytical	205 Analytical Chemistry
210 Inorganic	215 Synthetic Organic & Organometallic Chemistry
220 Organic	225 Synthetic, Inorganic & Natural Products
230 Nuclear	235 Nuclear Chemistry
240 Physical	245 Quantum Chemistry
250 Theoretical	255 Structural Chemistry
260 Agricultural & Food	265 Thermodynamics & Material Properties
270 Pharmaceutical	275 Polymers
298 Chemistry, General	285 Chemical Dynamics
299 Chemistry, Other*	

NOTE: Please use List B fields to classify your doctoral degree in Item 9. This is a classification which is requested in addition to the field chosen from List A. Print the List B field beside the doctoral code number from List A.

EARTH, ENVIRONMENTAL & MARINE SCIENCES

301 Mineralogy, Petrology
305 Geochemistry
310 Stratigraphy, Sedimentation
320 Paleontology
330 Structural Geology
340 Geophysics (Solid Earth & Atmospheric)
350 Geomorph., Glacial Geology
360 Hydrology
370 Oceanography
380 Meteorology
388 Environmental Sciences, General
389 Environmental Sciences, Other*
391 Applied Geology, Geol. Engr., Econ. Geol.
397 Marine Sciences, Other*
398 Earth Sciences, General
399 Earth Sciences, Other*

ENGINEERING

400 Aeronautical & Astronautical
410 Agricultural
415 Biomedical
420 Civil
430 Chemical
435 Ceramic
440 Electrical
445 Electronics
450 Industrial, Manufacturing
455 Nuclear
460 Engineering Mechanics
465 Engineering Physics
470 Mechanical
475 Metallurgy & Phys. Met. Engr.
477 Operations Research, Systems (see also 082)
479 Fuel Technology, Petrol. Engr.
480 Sanitary/Environmental
486 Mining
497 Materials Science Engr.
498 Engineering, General
499 Engineering, Other*

AGRICULTURAL SCIENCES

500 Agronomy
501 Agricultural Economics
502 Animal Husbandry
504 Fish & Wildlife
505 Forestry
506 Horticulture
507 Soils & Soil Science
510 Animal Sciences
511 Phytopathology
517 Food Science & Technology (see also 573)
518 Agriculture, General
519 Agriculture, Other*

MEDICAL SCIENCES

520 Medicine & Surgery
522 Public Health
523 Veterinary Medicine
524 Hospital Administration
527 Parasitology
534 Pathology
536 Pharmacology
537 Pharmacy
538 Medical Sciences, General
539 Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 Biochemistry
542 Biophysics
543 Biomathematics
544 Biometrics, Biostatistics (see also 055, 670, 725, 729)
545 Anatomy
546 Cytology
547 Embryology
548 Immunology
550 Botany
560 Ecology
562 Hydrobiology
564 Microbiology & Bacteriology
566 Physiology, Animal
567 Physiology, Plant
569 Zoology
570 Genetics
571 Entomology
572 Molecular Biology
573 Food Science & Technology (see also 517)
574 Behavior/Ethology
578 Biological Sciences, General
579 Biological Sciences, Other*

PSYCHOLOGY

600 Clinical
610 Counseling & Guidance
620 Developmental & Gerontological
630 Educational
635 School Psychology
641 Experimental
642 Comparative
643 Physiological
650 Industrial & Personnel
660 Personality
670 Psychometrics (see also 055, 544, 725, 729)
680 Social
698 Psychology, General
699 Psychology, Other*

SOCIAL SCIENCES

700 Anthropology
703 Archeology
708 Communications*
709 Linguistics
710 Sociology
720 Economics (see also 501)
725 Econometrics (see also 055, 544, 670, 729)
729 Social Statistics (see also 055, 544, 670, 725)
740 Geography
745 Area Studies*
750 Political Science, Public Admin.
755 International Relations
770 Urban & Reg. Planning
775 History & Phil. of Science
798 Social Sciences, General
799 Social Sciences, Other*

ARTS & HUMANITIES

841 Fine & Applied Arts (including Music, Speech, Drama, etc.)
842 History
843 Philosophy, Religion, Theology
845 Languages & Literature
846 Other Arts and Humanities*

EDUCATION & OTHER PROFESSIONAL FIELDS

938 Education

882 Business Administration
883 Home Economics
884 Journalism
885 Speech and Hearing Sciences
886 Law, Jurisprudence
887 Social Work
891 Library & Archival Science
898 Professional Field, Other*

899 OTHER FIELDS*

* Identify the specific field in the space provided on the questionnaire.

7-1

APPENDIX D

Questionnaire and Specialties List
1977 Survey of Doctorate Recipients

OMB No. 099-R0294

1977 SURVEY OF DOCTORATE RECIPIENTS

CONDUCTED BY THE NATIONAL RESEARCH COUNCIL WITH THE SUPPORT OF THE NATIONAL SCIENCE FOUNDATION, THE NATIONAL ENDOWMENT FOR THE HUMANITIES, AND THE NATIONAL INSTITUTES OF HEALTH

THE ACCOMPANYING LETTER requests your assistance in this biennial survey of Ph.D.'s in the humanities, sciences, and engineering.
PLEASE READ the instructions for each question carefully and answer by printing your reply or checking the appropriate box.
PLEASE CHECK the pre-printed information to be certain that it is correct and complete.
PLEASE RETURN the completed form in the enclosed envelope to the Commission on Human Resources, JH 638, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.
NOTE: THIS INFORMATION IS SOLICITED UNDER THE AUTHORITY OF THE NATIONAL SCIENCE FOUNDATION ACT OF 1950, AS AMENDED. ALL INFORMATION YOU PROVIDE WILL BE TREATED AS CONFIDENTIAL AND USED FOR STATISTICAL PURPOSES ONLY. INFORMATION WILL BE RELEASED ONLY IN THE FORM OF STATISTICAL SUMMARIES OR IN A FORM WHICH DOES NOT IDENTIFY INFORMATION ABOUT ANY PARTICULAR PERSON. YOUR RESPONSE IS ENTIRELY VOLUNTARY AND YOUR FAILURE TO PROVIDE SOME OR ALL OF THE REQUESTED INFORMATION WILL IN NO WAY ADVERSELY AFFECT YOU.

If your name and address are incorrect, please enter correct information above. Include ZIP CODE. (10)

If there is an alternate address through which you can always be reached, please provide it on the line below.

C/O Number Street City State ZIP Code (11)

1. Date of Birth Mo. Day Year (12-16)	2. State or Foreign Country of Birth (17-18)	3. Citizenship 0 ☐ U.S.A. 1 ☐ Non-U.S.A., Specify Country (19) (20-21)	4. Sex 1 ☐ M 2 ☐ F (22)

5. What is your racial background?
0 ☐ American Indian or Alaskan Native
1 ☐ Asian or Pacific Islander
2 ☐ Black
3 ☐ White
(23)

5a. Is your ethnic heritage Hispanic?
0 ☐ Yes
1 ☐ No
(24)

6. List in the table below all collegiate and graduate degrees, excluding honorary degrees, that have been awarded to you. Please check the pre-printed information, including the number and name of the specialty from the list on page 4, to be certain that it is correct and complete.

Type of Degree	Granted Mo. Yr.	Major Field (Use Specialties List) Name Number	Institution Name	City (or Campus) & State
Bachelor's				
Master's				
Doctorate				
Other (Specify)				

7. What was your employment status as of February 6-12, 1977? (Check only one category.)

Employed full-time in field of Ph.D. ☐ 1
Employed full-time in field other than field of Ph.D. ☐ 2
Employed part-time ☐ 3
Were you seeking full-time employment? 1 ☐ Yes 2 ☐ No (66)
Postdoctoral appointment (fellowship, traineeship, research associateship, etc.) ☐ 4
Unemployed and seeking employment ☐ 5
Not employed and not seeking employment ☐ 6
Retired and not employed ☐ 7
Other, specify _____ ☐ 8
(65)

7a. If you were employed full-time during February 6-12, 1977, in a field other than your field of Ph.D., what was the MOST important reason for taking the position?

Preferred position outside Ph.D. field ☐ 1
Promoted out of position in Ph.D. field ☐ 2
Better pay ☐ 3
Locational factors ☐ 4
Position in Ph.D. field not available ☐ 5
Other, specify _____ ☐ 6
(67)

If you checked 5, 6 or 7, ANSWER ONLY 8a, 9a, 13, 14 and 17 of the following questions.

8. Which category below best describes the type of organization of your principal employment OR postdoctoral appointment during February 6-12, 1977? (Check only one category.)

- ☐ 1 Business or industry
- ☐ 2 Junior college, 2-year college, technical institute
- ☐ 3 Medical school
- ☐ 4 4-Year college
- ☐ 5 University, other than medical school
- ☐ 6 Elementary or secondary school system
- ☐ 7 Private foundation
- ☐ 8 Museum or historical society
- ☐ 9 Research library or archives
- ☐ 10 Hospital or clinic
- ☐ 11 U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA
- ☐ 12 U.S. government, civilian employee
- ☐ 13 State government
- Local or other government, specify:
  - ☐ 14 _____
- ☐ 15 Non-profit organization, other than those listed above
- ☐ 16 Other, specify: _____

(68-69)

8a. Which of the above categories best describes the type of organization related to your first position following the receipt of your doctorate? (List only one category)

_____ Type of Organization (70-71)

9. What percent of time did you devote to each of the following activities during the week of February 6-12, 1977? (Total should equal 100%) **What were your primary (A) and secondary (B) work activities?** (Check only one in each column.)

	%	A	B
Management or administration of			
Research and development	_____ (10)	☐ 1	☐
Other than research and development	_____ (12)	☐ 2	☐
Both	_____ (14)	☐ 3	☐
Basic research	_____ (16)	☐ 4	☐
Applied research	_____ (18)	☐ 5	☐
Development of equipment, products, systems, data	_____ (20)	☐ 6	☐
Development of humanities resource materials	_____ (22)	☐ 7	☐
Design	_____ (24)	☐ 8	☐
Teaching	_____ (26)	☐ 9	☐
Writing, editing	_____ (28)	☐ 10	☐
Curatorial	_____ (30)	☐ 11	☐
Production	_____ (32)	☐ 12	☐
Consulting, specify: _____	_____ (34)	☐ 13	☐
Professional services to individuals	_____ (36)	☐ 14	☐
Quality control, inspection, testing	_____ (38)	☐ 15	☐
Sales, marketing, purchasing, estimating	_____ (40)	☐ 16	☐
Other, specify: _____	_____ (42)	☐ 17	☐
	Total = 100%		(44-47)

9a. Which of the above categories best describes the primary work activity related to your first position following the receipt of your doctorate?

_____ Primary Work Activity Number (48-49)

10. From the Degree and Employment Specialties List on page 4 select and enter both the number and title of the employment specialty most closely related to your principal employment or postdoctoral appointment during the week of February 6-12, 1977. Write in your specialty if it is not on the list.

_____ _____
Number Title of Employment Specialty (50-52)

11. Please give the name of your principal employer (organization, company, etc. or, if self employed, write "self"), and actual place of employment as of the week of February 6-12, 1977.

_____
Name of Employer (53-58)

_____
Number Street

_____
City State ZIP Code
(59-63)

12. What was the basic annual salary* associated with your principal professional employment during the week of February 6-12, 1977? If you were on a postdoctoral appointment (e.g., fellowship, traineeship, research associateship), what was your annual stipend plus allowances?

$ _____ per year (64-66)

*NOTE: Basic annual salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work.

IF ACADEMICALLY EMPLOYED:

a. Check whether salary was for ☐ 9-10 months or ☐ 11-12 months. (67)

b. Did you hold a tenured position during February 6-12, 1977? 0 ☐ Yes 1 ☐ No (68)
If Yes, what year was tenure granted? _____ (69-70)

c. What was the rank of your position? (Check only one.)

- 1 ☐ Professor
- 2 ☐ Associate Professor
- 3 ☐ Assistant professor
- 4 ☐ Instructor
- 5 ☐ Lecturer
- 6 ☐ Other, specify: _____ (71)

d. What, if any, administrative position did you hold?

- 1 ☐ Dean
- 2 ☐ Department Chairman
- 3 ☐ President or Chancellor
- 4 ☐ Vice-President or Vice-Chancellor
- 5 ☐ Other, specify: _____
- 6 ☐ Does not apply

(72)

13. **How many full-time equivalent years of professional work experience, including teaching, have you had?** _____ **Year(s)** (73-74)

14. **Following completion of your doctorate have you ever held a fellowship, traineeship, or research associateship?** 0 ☐ Yes 1 ☐ No (75)

15. **Listed below are selected topics of national interest. If you devoted a proportion of your professional time which you considered significant to any of these problem areas during the week of February 6-12, 1977, please check the box for the one on which you spent the MOST time.**

1 ☐ Health
2 ☐ Defense
3 ☐ Environmental protection, pollution control
4 ☐ Education
5 ☐ Space
6 ☐ Crime prevention and control
7 ☐ Energy and fuel
8 ☐ Food and other agricultural products
9 ☐ Natural resources,other than fuel or food
10 ☐ Community development and services
11 ☐ Housing (planning, design, construction)
12 ☐ Transportation, communications
13 ☐ Cultural life
14 ☐ Other area, specify: _____
15 ☐ Does not apply

(10-11)

16. **Was any of your work in the week of February 6-12, 1977 supported or sponsored by U.S. Government funds?**

0 ☐ Yes 1 ☐ No 2 ☐ Don't know (12)

If Yes, which of the following federal agencies or departments were supporting the work? (Check all that apply.)

13 ☐ Agency for International Development
14 ☐ Energy Research & Development Administration
15 ☐ Environmental Protection Agency
16 ☐ National Aeronautics & Space Administration
17 ☐ National Endowment for the Arts
18 ☐ National Endowment for the Humanities
19 ☐ National Science Foundation
20 ☐ Nuclear Regulatory Commission
21 ☐ Smithsonian Institution
22 ☐ Department of Agriculture
23 ☐ Department of Commerce
24 ☐ Department of Defense

Department of Health, Education, and Welfare
25 ☐ National Institutes of Health
26 ☐ Alcohol, Drug Abuse & Mental Health Administration
27 ☐ National Institute of Education
28 ☐ Office of Education
29 ☐ Other, specify: _____
30 ☐ Department of Housing and Urban Development
31 ☐ Department of the Interior
32 ☐ Department of Justice
33 ☐ Department of Labor
34 ☐ Department of State
35 ☐ Department of Transportation
36 ☐ Other agency or department, specify: _____
37 ☐ Don't know source agency

17. **If you received your doctoral degree in science or engineering or are employed as a scientist or engineer, please check all that apply below:**

☐ (a) Changed positions during the period 1973 to 1976.
☐ (b) Received doctoral degree in 1965 or later and employed sometime since receiving your doctoral degree in industry, government, or as non-faculty academic staff.
☐ (c) Held a postdoctoral appointment any year during 1970-1976 inclusive.
☐ (d) None of the above apply. (38-41)

If you have checked *a*, b, or c, please give a brief career history starting with the position prior to your present position and continuing back in time for a maximum of four positions after receiving your doctoral degree (include postdoctoral appointments).

	Name and Location (City and State) of Employer	Position Title	Dates Held	Primary Work Activity*	Employment Specialty (Use Degree & Employment Specialties List)	Reason for Leaving Position
1						
2						
3						
4						

*Enter code (1-17) from the list given in item 9.

(a) Of the positions described above, as well as your present position, please check any in which your doctoral training was/is not being used.
☐ Position 1 ☐ Position 2 ☐ Position 3 ☐ Position 4 ☐ Present Position ☐ None

(74-79)

DEGREE AND EMPLOYMENT SPECIALTIES LIST

MATHEMATICAL SCIENCES

000 Algebra
010 Analysis & Functional Analysis
020 Geometry
030 Logic
040 Number Theory
052 Probability
055 Math. Statistics (see also 544, 670, 725, 729)
060 Topology
082 Operations Research (see also 479)
085 Applied Mathematics
089 Combinatorics & Finite Mathematics
091 Physical Mathematics
098 Mathematics, General
099 Mathematics, Other*

COMPUTER SCIENCES

071 Theory
072 Software Systems
073 Hardware Systems
074 Intelligent Systems
079 Computer Sciences, Other

PHYSICS & ASTRONOMY

101 Astronomy
102 Astrophysics
110 Atomic & Molecular Physics
120 Electromagnetism
130 Mechanics
132 Acoustics
134 Fluids
135 Plasma Physics
136 Optics
138 Thermal Physics
140 Elementary Particles
150 Nuclear Structure
160 Solid State
198 Physics, General
199 Physics, Other*

CHEMISTRY

200 Analytical
210 Inorganic
215 Synthetic Inorganic & Organometallic
220 Organic
225 Synthetic Organic & Natural Products
230 Nuclear
240 Physical
245 Quantum
250 Theoretical
255 Structural
260 Agricultural & Food
265 Thermodynamics & Material Properties
270 Pharmaceutical
275 Polymers
280 Biochemistry (see also 540)
285 Chemical Dynamics
298 Chemistry, General
299 Chemistry, Other*

EARTH, ENVIRONMENTAL AND MARINE SCIENCES

301 Mineralogy, Petrology
305 Geochemistry
310 Stratigraphy, Sedimentation
320 Paleontology
330 Structural Geology
341 Geophysics (Solid Earth)
350 Geomorph. & Glacial Geology
391 Applied Geol., Geol. Engr. & Econ. Geol.
395 Fuel Tech. & Petrol. Engr. (see also 479)
360 Hydrology & Water Resources
370 Oceanography
397 Marine Sciences, Other*
381 Atmospheric Physics & Chemistry
382 Atmospheric Dynamics
383 Atmospheric Sciences, Other*
388 Environmental Sciences, General (see also 480, 528)
389 Environmental Sciences, Other*
398 Earth Sciences, General
399 Earth Sciences, Other*

ENGINEERING

400 Aeronautical & Astronautical
410 Agricultural
415 Biomedical
420 Civil
430 Chemical
435 Ceramic
440 Electrical
445 Electronics
450 Industrial & Manufacturing
455 Nuclear
460 Engineering Mechanics
465 Engineering Physics
470 Mechanical
475 Metallurgy & Phys. Met. Engr.
476 Systems Design & Systems Science (see also 072, 073, 074)
478 Operations Research (see also 082)
479 Fuel Technology & Petrol. Engr.
480 Sanitary & Environmental
486 Mining
497 Materials Science Engr.
498 Engineering, General
499 Engineering, Other*

AGRICULTURAL SCIENCES

500 Agronomy
501 Agricultural Economics
502 Animal Husbandry
504 Fish & Wildlife
505 Forestry
506 Horticulture
507 Soils & Soil Science
510 Animal Science & Animal Nutrition
511 Phytopathology
517 Food Science & Technology (see also 573)
518 Agriculture, General
519 Agriculture, Other*

MEDICAL SCIENCES

520 Medicine & Surgery
522 Public Health & Epidemiology
523 Veterinary Medicine
524 Hospital Administration
526 Nursing
527 Parasitology
528 Environmental Health
534 Pathology
536 Pharmacology
537 Pharmacy
538 Medical Sciences, General
539 Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 Biochemistry (see also 280)
542 Biophysics
543 Biomathematics
544 Biometrics, Biostatistics (see also 055, 670, 725, 729)
545 Anatomy
546 Cytology
547 Embryology
548 Immunology
550 Botany
560 Ecology
562 Hydrobiology
564 Microbiology & Bacteriology
566 Physiology, Animal
567 Physiology, Plant
569 Zoology
570 Genetics
571 Entomology
572 Molecular Biology
573 Food Science & Technology (see also 517)
574 Behavior/Ethology
576 Nutrition & Dietetics
578 Biological Sciences, General
579 Biological Sciences, Other*

PSYCHOLOGY

600 Clinical
610 Counseling & Guidance
620 Developmental & Gerontological
630 Education
635 School Psychology
641 Experimental
642 Comparative
643 Physiological
650 Industrial & Personnel
660 Personality
670 Psychometrics (see also 055, 544, 725, 729)
680 Social
698 Psychology, General
699 Psychology, Other*

SOCIAL SCIENCES

700 Anthropology
703 Archeology
708 Communications*
709 Linguistics
710 Sociology
720 Economics (see also 501)
725 Econometrics (see also 055, 544, 670, 729)
729 Social Statistics (see also 055, 544, 670, 725)
740 Geography
745 Area Studies*
751 Political Science
752 Public Administration
755 International Relations
770 Urban & Regional Planning
775 History & Philosophy of Science
798 Social Sciences, General
799 Social Sciences, Other*

HUMANITIES

802 History & Criticism of Art
804 History, American
805 History, European
806 History, Other*
808 American Studies
830 Music
831 Speech as a Dramatic Art (see also 885)
833 Religion (see also 881)
834 Philosophy
836 Comparative Literature
878 Humanities, General
879 Humanities, Other*
891 Library & Archival Sciences

LANGUAGES & LITERATURE

811 American
812 English
821 German
822 Russian
823 French
824 Spanish & Portuguese
826 Italian
827 Classical*
829 Other Languages*

EDUCATION & OTHER PROFESSIONAL FIELDS

938 Education
801 Art, Applied
881 Theology (see also 833)
882 Business Administration
883 Home Economics
884 Journalism
885 Speech & Hearing Sciences (see also 831)
886 Law, Jurisprudence
887 Social Work
897 Professional Field, Other*

899 OTHER FIELDS*

79

*Identify the specific field in the space on the questionnaire.

APPENDIX E

Questionnaire and Specialties List
Survey of Earned Doctorates

NSF Form 558 1977
OMB No. 99-R0290
Approval Expires June 30, 1979

SURVEY OF EARNED DOCTORATES

This form is to be returned to the GRADUATE DEAN, for forwarding to ..... Board on Human-Resource Data and Analyses
Commission on Human Resources
National Research Council
2101 Constitution Avenue, Washington, D. C. 20418

Please print or type

A. Name in full: ..... (9-30)
(Last Name) (First Name) (Middle Name)

Cross Reference: Maiden name or former name legally changed ..... (31)

B. Permanent address through which you could always be reached: (Care of, if applicable) .....

.....
(Number) (Street) (City)

.....
(State) (Zip Code) (Or Country if not U.S.)

C. U.S. Social Security Number: ___ ___ ___ - ___ ___ - ___ ___ ___ ___ (32-40)

D. Date of birth: ..... (41-45) (Month) (Day) (Year) Place of birth: ..... (46-47) (State) (Or Country if not U.S.)

E. Sex: 1 ☐ Male 2 ☐ Female (48)

F. Marital status: 1 ☐ Married 2 ☐ Not married (including widowed, divorced) (49)

G. Citizenship: 0 ☐ U.S. native 2 ☐ Non-U.S., Immigrant (Permanent Resident)
1 ☐ U.S. naturalized 3 ☐ Non-U.S., Non-Immigrant (Temporary Resident) (50)
If Non-U.S., indicate country of present citizenship ..... (51-52)

H. Racial or ethnic group: (Check all that apply.) *A person having origins in —*
0 ☐ American Indian or Alaskan Native ..... any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.
1 ☐ Asian or Pacific Islander ..... any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands. This area includes, for example, China, Japan, Korea, the Philippine Islands, and Samoa.
2 ☐ Black, not of Hispanic Origin ..... any of the black racial groups of Africa.
3 ☐ White, not of Hispanic Origin ..... any of the original peoples of Europe, North Africa, or the Middle East.
4 ☐ Hispanic ..... Mexican, Puerto Rican, Central or South American, or other Spanish culture or origins, regardless of race. (53-55)

I. Number of dependents: Do not include yourself. (Dependent = someone receiving at least one half of his or her support from you) ..... (56)

J. U.S. veteran status: 0 ☐ Veteran 1 ☐ On active duty 2 ☐ Non-veteran or not applicable (57)

EDUCATION

K. High school last attended: ..... (58-59)
(School Name) (City) (State)

Year of graduation from high school: ..... (60-61)

L. List in the table below all collegiate and graduate institutions you have attended including 2-year colleges. List chronologically, and include your doctoral institution as the last entry.

Institution Name	Location	Years Attended		Major Field		Minor Field	Degree (if any)		
				Use Specialties List			Title of Degree	Granted	
		From	To	Name	Number	Number		Mo.	Yr.

M. Enter below the title of your doctoral dissertation and the most appropriate classification number and field. If a project report or a musical or literary composition (not a dissertation) is a degree requirement, please check box. ☐ (44)

Title .....
.....
.....

Classify using Specialties List
Number Name of field
....

N. Name the department (or interdisciplinary committee, center, institute, etc.) and school or college of the university which supervised your doctoral program: .....
(Department/Institute/Committee/Program) (School)

O. Name of your dissertation adviser: .....
(Last Name) (First Name) (Middle Initial)

continued on next page 7681

SURVEY OF EARNED DOCTORATES, Cont.

P. Please enter a "1" beside your primary source of support during graduate study. Enter a "2" beside your secondary source of support during graduate study. Check all other sources from which support was received.

58 ___ NSF Fellowship
59 ___ NSF Traineeship
60 ___ NIH Fellowship
61 ___ NIH Traineeship
62 ___ NDEA Fellowship
63 ___ Other HEW
64 ___ AEC/ERDA Fellowship
65 ___ NASA Traineeship
66 ___ GI Bill
67 ___ Other Federal support (specify) .....
68 ___ Woodrow Wilson Fellowship
69 ___ Other U.S. national fellowship (specify) .....
70 ___ University Fellowship
71 ___ Teaching Assistantship
72 ___ Research Assistantship
73 ___ Educational fund of industrial or business firm
74 ___ Other institutional funds (specify) .....
75 ___ Own earnings
76 ___ Spouse's earnings
77 ___ Family contributions
78 ___ Loans (NDSL direct)
79 ___ Other loans
80 ___ Other (specify) .....

Q. Please check the space which most fully describes your status during the year immediately preceding the doctorate.

0 ☐ Held fellowship
1 ☐ Held assistantship
2 ☐ Held own research grant
3 ☐ Not employed
4 ☐ Part-time employed

Full-time Employed in: (Other than 0, 1, 2)

5 ☐ College or university, teaching
6 ☐ College or university, non-teaching
7 ☐ Elem. or sec. school, teaching
8 ☐ Elem. or sec. school, non-teaching
9 ☐ Industry or business
(11) ☐ Other (specify) .....
(12) ☐ Any other (specify) ..... (9)

R. How many years (full-time equivalent basis) of professional work experience did you have prior to the doctorate? (include assistantships as professional experience) ..... (10-11)

S. How well defined are your postgraduation plans?
0 ☐ Have signed contract or made definite commitment
1 ☐ Am negotiating with a specific organization, or more than one
2 ☐ Am seeking appointment but have no specific prospects
3 ☐ Other (specify) ..... (12)

T. What are your immediate postgraduation plans?
0 ☐ Postdoctoral fellowship? } Go to Item "U"
1 ☐ Postdoctoral research associateship? } Go to Item "U"
2 ☐ Traineeship? } Go to Item "U"
3 ☐ Other study (specify) ..... } Go to Item "U"
4 ☐ Employment (other than 0, 1, 2, 3) } Go to Item "V"
5 ☐ Military service? } Go to Item "V"
6 ☐ Other (specify) ..... (13) } Go to Item "V"

U. If you plan to be on a postdoctoral fellowship, associateship, traineeship or other study

What will be the field of your postdoctoral study?
Classify using Specialties List
Number Field
..... (14-16)

What will be the primary source of support?
0 ☐ U.S. Government
1 ☐ College or university
2 ☐ Private foundation
3 ☐ Nonprofit, other than private foundation
4 ☐ Other (specify) ..... (17)
6 ☐ Unknown

Go to Item "W"

V. If you plan to be employed, enter military service, or other — What will be the type of employer?
0 ☐ 4-year college or university other than medical school
1 ☐ Medical school
2 ☐ Jr. or community college
3 ☐ Elem. or sec. school
4 ☐ Foreign government
5 ☐ U.S. Federal government
6 ☐ U.S. state government
7 ☐ U.S. local government
8 ☐ Nonprofit organization
9 ☐ Industry or business
(11) ☐ Self-employed
(12) ☐ Other (specify) ..... (18)

Indicate *primary* work activity with "1" in appropriate box; *secondary* work activity (if any) with "2" in appropriate box.
0 ☐ Research and development
1 ☐ Teaching
2 ☐ Administration
3 ☐ Professional services to individuals
5 ☐ Other (specify) ..... (19-20)

In what field will you be working?
Please enter number from Specialties List ..... (21-23)

Go to Item "W"

W. What is the name and address of the organization with which you will be associated?

..... (Name of Organization)

..... (Street) ..... (City, State) ..... (Or Country if not U.S.) (24-29)

X. Please indicate, by circling the highest grade attained, the education of

		Elementary school							High school				College				Graduate			
your father:	none	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	MA, MD	PhD	Postdoctoral (30)
your mother	none 0	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	MA, MD	PhD	Postdoctoral (31)
		1			2			3		4			5	6			7	8	9	(11)

Signature ..... Date completed ..... (32-34)

SPECIALTIES LIST

MATHEMATICS

000 Algebra
010 Analysis & Functional Analysis
020 Geometry
030 Logic
040 Number Theory
050 Probability & Math. Statistics (see also 544, 670, 725, 727, 920)
060 Topology
080 Computing Theory & Practice
082 Operations Research (see also 478)
085 Applied Mathematics
098 Mathematics, General
099 Mathematics, Other*

COMPUTER SCIENCES

079 Computer Sciences* (see also 437)

ASTRONOMY

101 Astonomy
102 Astrophysics

PHYSICS

110 Atomic & Molecular
120 Electromagnetism
132 Acoustics
134 Fluids
135 Plasma
136 Optics
138 Thermal
140 Elementary Particles
150 Nuclear Structure
160 Solid State
198 Physics, General
199 Physics, Other*

CHEMISTRY

200 Analytical
210 Inorganic
220 Organic
230 Nuclear
240 Physical
250 Theoretical
260 Agricultural & Food
270 Pharmaceutical
275 Polymer
298 Chemistry, General
299 Chemistry, Other*

EARTH, ENVIRONMENTAL AND MARINE SCIENCES

301 Mineralogy, Petrology
305 Geochemistry
310 Stratigraphy, Sedimentation
320 Paleontology
330 Structural Geology
341 Geophysics (Solid Earth)
350 Geomorph. & Glacial Geology
391 Applied Geol., Geol. Engr. & Econ. Geol.
395 Fuel Tech. & Petrol. Engr. (see also 479)
360 Hydrology & Water Resources
370 Oceanography
397 Marine Sciences, Other*
381 Atmospheric Physics and Chemistry
382 Atmospheric Dynamics
383 Atmospheric Sciences, Other*
388 Environmental Sciences, General (see also 480, 528)
389 Environmental Sciences, Other*
398 Earth Sciences, General
399 Earth Sciences, Other*

ENGINEERING

400 Aeronautical & Astronautical
410 Agricultural
415 Biomedical
420 Civil
430 Chemical
435 Ceramic
437 Computer
440 Electrical
445 Electronics
450 Industrial
455 Nuclear
460 Engineering Mechanics
465 Engineering Physics
470 Mechanical
475 Metallurgy & Phys. Met. Engr.
476 Systems Design & Systems Science
478 Operations Research (see also 082)
479 Fuel Tech. & Petrol. Engr. (see also 395)
480 Sanitary & Environmental
486 Mining
497 Materials Science
498 Engineering, General
499 Engineering, Other*

AGRICULTURAL SCIENCES

500 Agronomy
501 Agricultural Economics
502 Animal Husbandry
503 Food Science & Technology
504 Fish & Wildlife
505 Forestry
506 Horticulture
507 Soils & Soil Science
510 Animal Science & Animal Nutrition
511 Phytopathology
518 Agriculture, General
519 Agriculture, Other*

MEDICAL SCIENCES

522 Public Health & Epidemiology
523 Veterinary Medicine
526 Nursing
527 Parasitology
528 Environmental Health
534 Pathology
536 Pharmacology
537 Pharmacy
538 Medical Sciences, General
539 Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 Biochemistry
542 Biophysics
544 Biometrics & Biostatistics (see also 050, 670, 725, 727, 920)
545 Anatomy
546 Cytology
547 Embryology
548 Immunology
550 Botany
560 Ecology
562 Hydrobiology
564 Microbiology & Bacteriology
566 Physiology, Animal
567 Physiology, Plant
569 Zoology
570 Genetics
571 Entomology
572 Molecular Biology
576 Nutrition and/or Dietetics
578 Biological Sciences, General
579 Biological Sciences, Other*

PSYCHOLOGY

600 Clinical
610 Counseling & Guidance
620 Developmental & Gerontological
630 Educational
635 School Psychology
641 Experimental
642 Comparative
643 Physiological
650 Industrial & Personnel
660 Personality
670 Psychometrics (see also 050, 544, 725, 727, 920)
680 Social
698 Psychology, General
699 Psychology, Other*

SOCIAL SCIENCES

700 Anthropology
708 Communications*
710 Sociology
720 Economics (see also 501)
725 Econometrics (see also 050, 544, 670, 727, 920)
727 Statistics (see also 050, 544, 670, 725, 920)
740 Geography
745 Area Studies*
751 Political Science
752 Public Administration
755 International Relations
770 Urban & Reg. Planning
798 Social Sciences, General
799 Social Sciences, Other*

HUMANITIES

802 History & Criticism of Art
804 History, American
805 History, European
806 History, Other*
807 History & Philosophy of Science
808 American Studies
809 Theatre and Theatre Criticism
830 Music
831 Speech as a Dramatic Art (see also 885)
832 Archeology
833 Religion (see also 881)
834 Philosophy
835 Linguistics
836 Comparative Literature
878 Humanities, General
879 Humanities, Other*

LANGUAGES & LITERATURE

811 American
812 English
821 German
822 Russian
823 French
824 Spanish & Portuguese
826 Italian
827 Classical*
829 Other Languages*

EDUCATION

900 Foundations: Social & Philosoph.
910 Educational Psychology
908 Elementary Educ., General
909 Secondary Educ., General
918 Higher Education
919 Adult Educ. & Extension Educ.
920 Educ. Meas. & Stat.
929 Curriculum & Instruction
930 Educ. Admin. & Superv.
940 Guid., Couns., & Student Pers.
950 Soecial Education (Gifted, Handicapped, etc.)
960 Audio-Visual Media

TEACHING FIELDS

970 Agriculture Educ.
972 Art Educ.
974 Business Educ.
976 English Educ.
978 Foreign Languages Educ.
980 Home Economics Educ.
982 Industrial Arts Educ.
984 Mathematics Educ.
986 Music Educ.
988 Phys. Ed., Health, & Recreation
989 Reading Education
990 Science Educ.
992 Social Science Educ.
993 Speech Education
994 Vocational Educ.
996 Other Teaching Fields*

998 Education, General
999 Education, Other*

OTHER PROFESSIONAL FIELDS

881 Theology (see also 833)
882 Business Administration
883 Home Economics
884 Journalism
885 Speech & Hearing Sciences (see also 831)
886 Law & Jurisprudence
887 Social Work
891 Library & Archival Science
897 Professional Field, Other*

899 OTHER FIELDS*

* Identify the specific field in the space provided on the questionnaire.

APPENDIX F

WEIGHTING PROCEDURE

The weighting system used in this report to "blow up" the numbers of sample cases to represent a simulated population are significantly different from those used in the biennial Profile reports and other reports based on the same data banks. In the other reports, two weights are used. One shows the number of cases within the cell which the sample represents, the other compensates for nonresponse of sample members within the cell. The product of these two weights provides a parameter value for the cell, and, by summation across the cells, for the entire science and engineering Ph.D. population.

In this report, we were not concerned with representing the entire population, except in the Introduction, where there was an accounting for those deceased, retired, or nonresponding. For this purpose, the nonresponse weight would of course be inapplicable. Only the sample weights were therefore used at this point. The effect of the sample weights was to insure that the populous cells, with the sparest sampling, were properly represented, as would the smallest cells, in which the sample was 100 percent.

In the later portions of the report, we were not concerned with trying to estimate population parameters, but only to accurately represent the field, sex, and cohort proportions within the group of active respondents. For this also, weights for nonresponders would be irrelevant and misleading. The sample weights were therefore retained throughout, with the result that the numbers of reported scientists, by field group, employer category, or primary work activity, or for the total combined, would not even approximate the totals for the whole population, as given in the other reports. The focus here was on patterns within the employed respondent groups, not on population parameters, and the weights used were selected accordingly.